THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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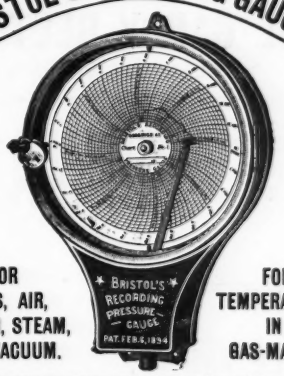

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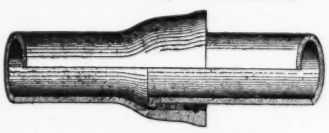

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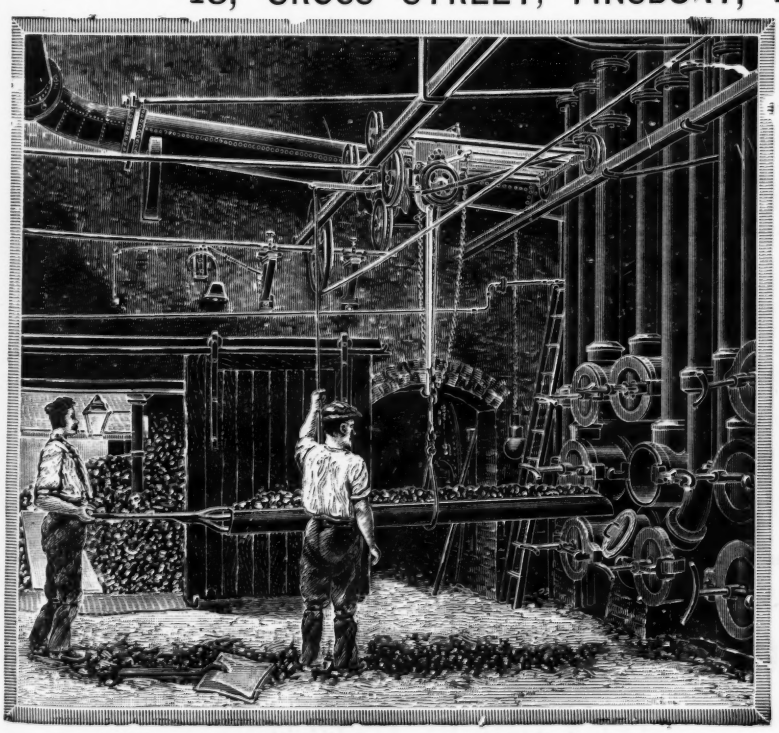

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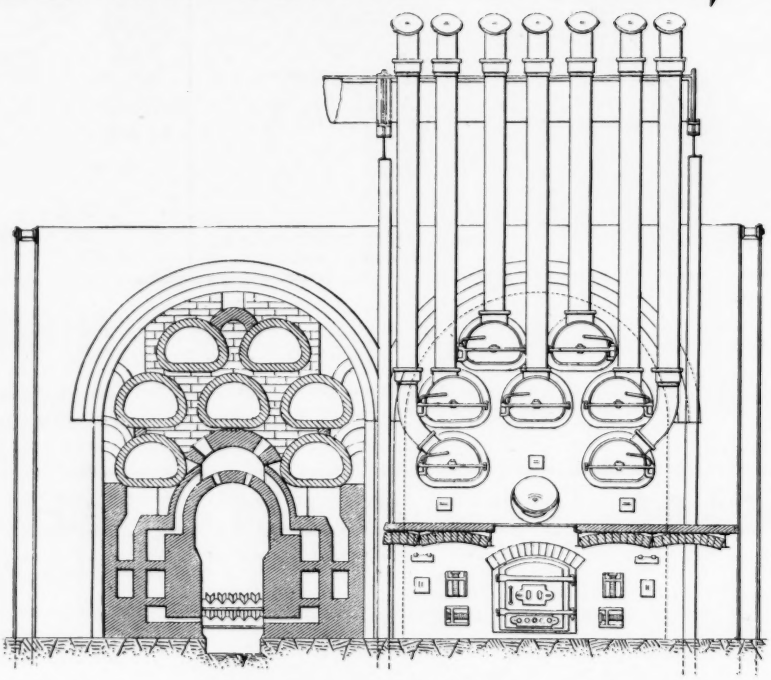

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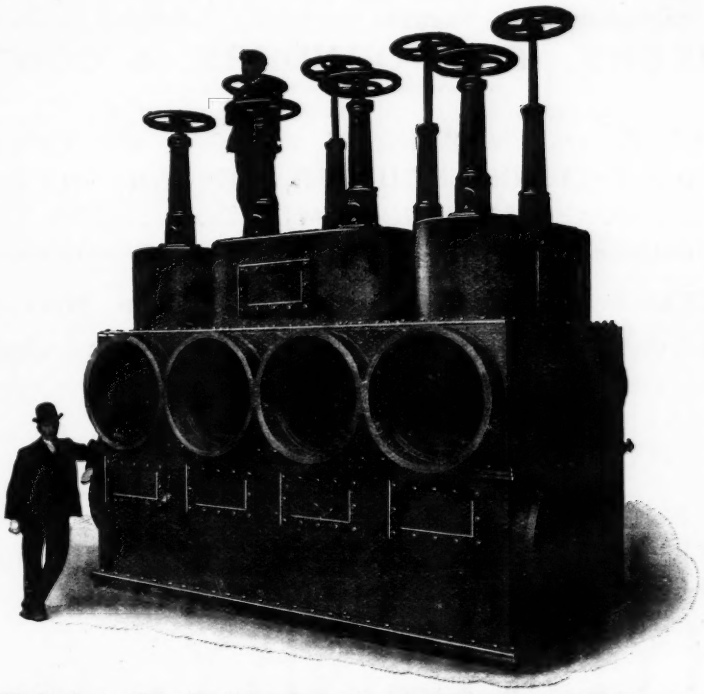

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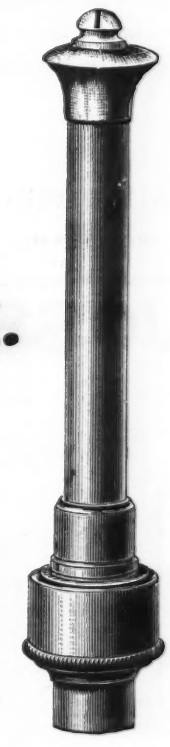

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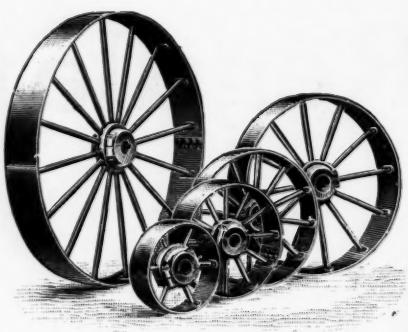

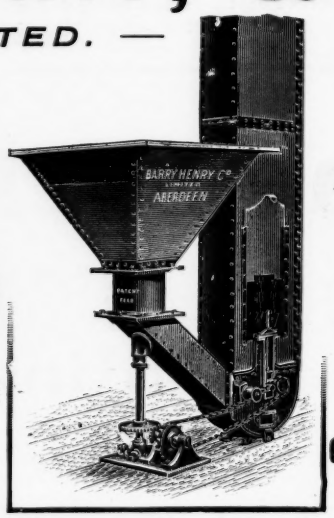

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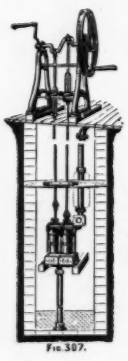

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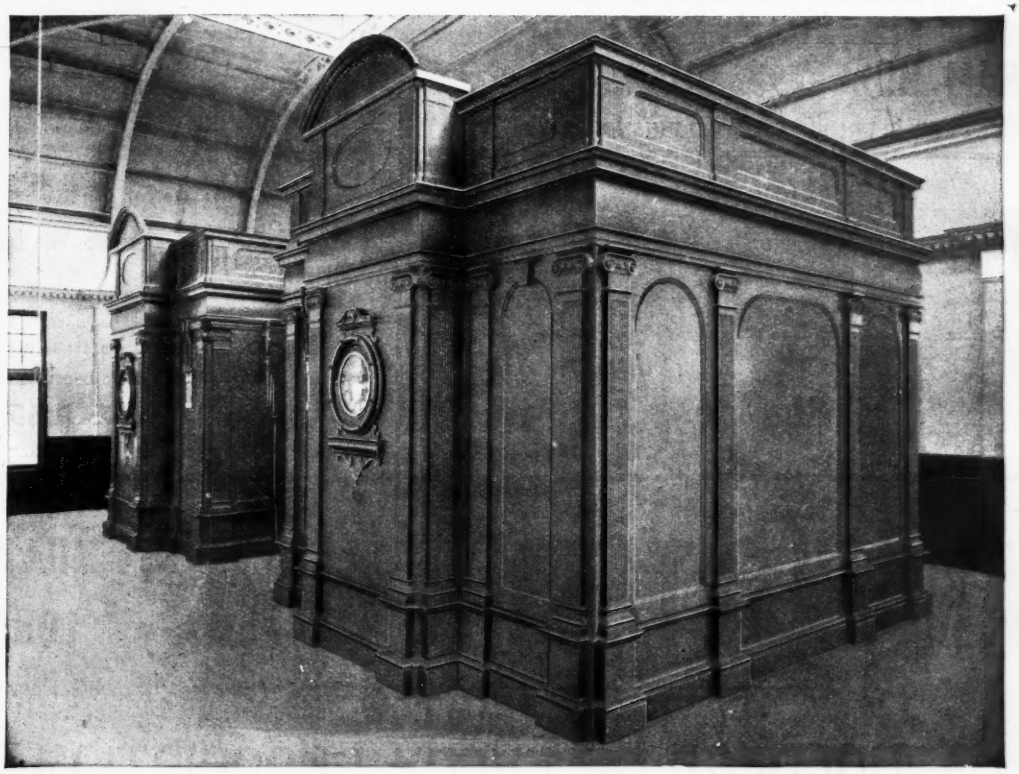

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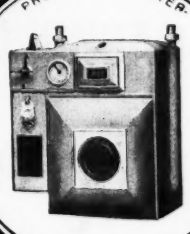

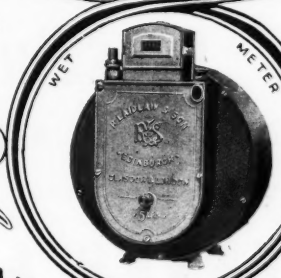

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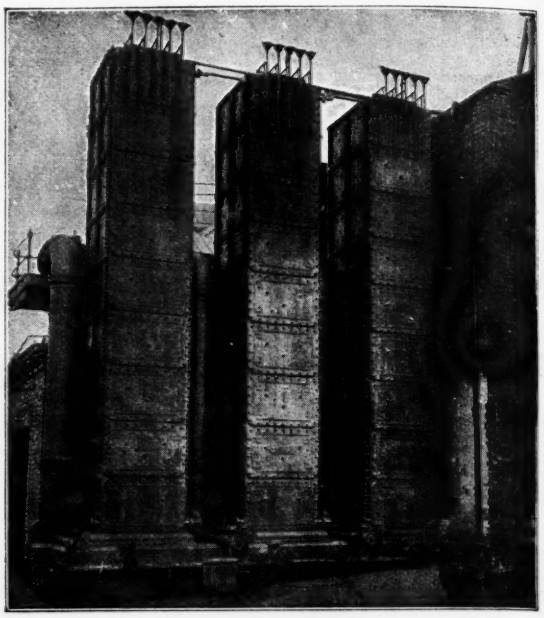

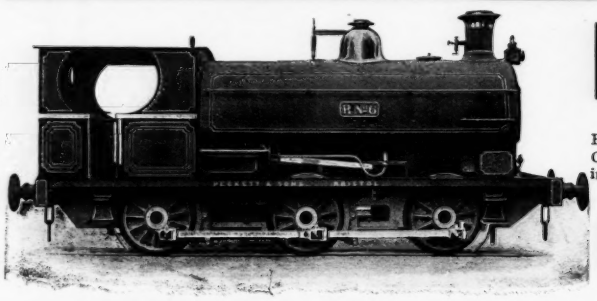

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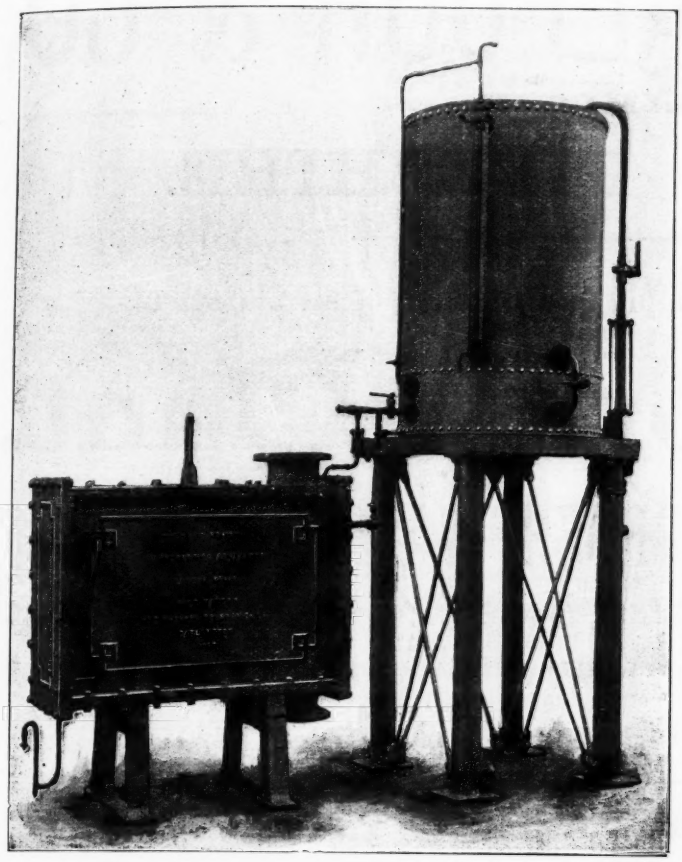

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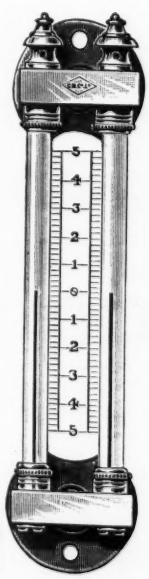

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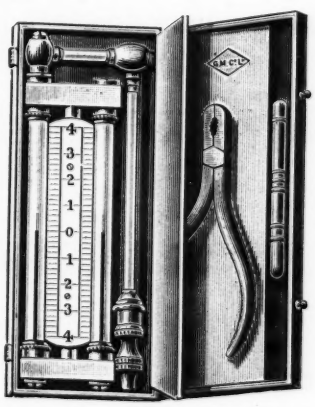

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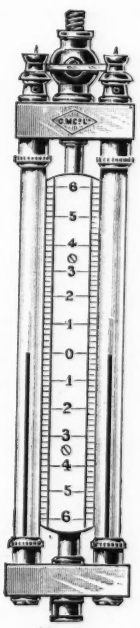

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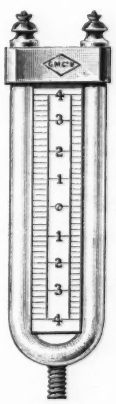

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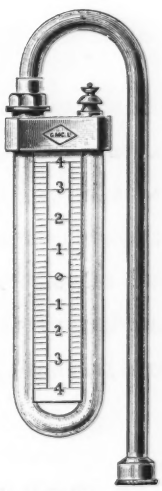

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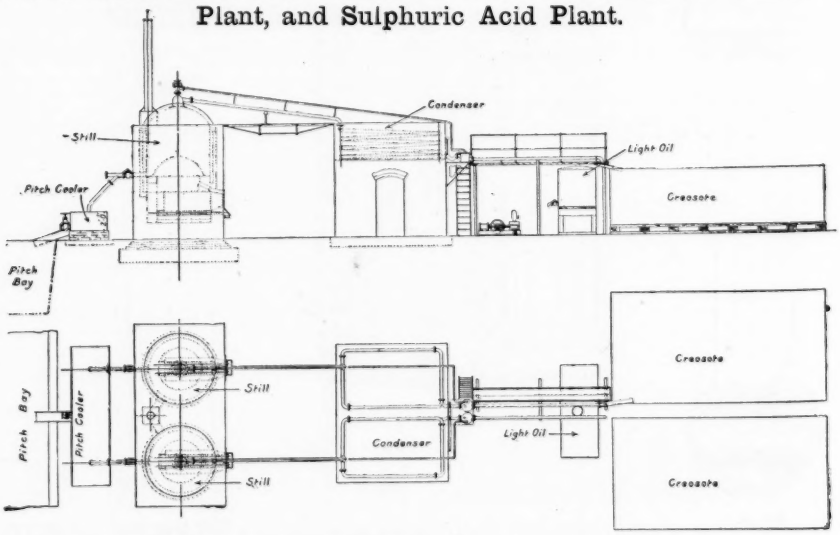

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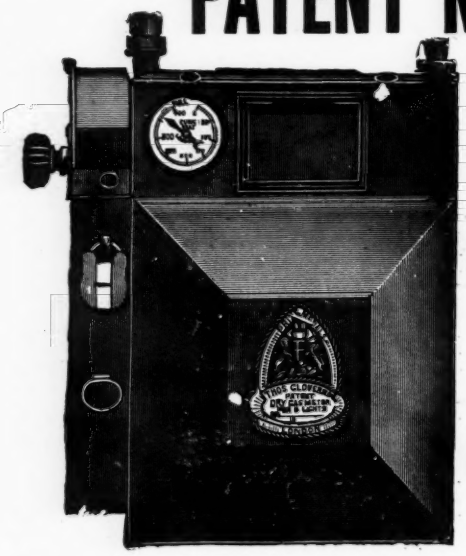

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EDITORIAL NOTES.

The Commercial Company under the New Régime.

THE report of what transpired at the meeting of the Commercial Gas Company last Thursday will receive very attentive perusal by those who are interested in learning how the Company have fared under the changes effected by the Act of 1902. The dominant note of the proceedings will be found to be one of contentment with the situation and prospect; and therefore it follows that everything under the new conditions is going ahead satisfactorily. The lower illuminating power gas has been supplied during the half year; but the Engineer (Mr. Stanley Jones) has not received a single complaint from the consumers. The consumers, in consequence of the reduction in the illuminating power, have paid less by £11,567 for the quantity of gas consumed than they would otherwise have done; yet, on the other hand, this is the first occasion for six half years that the proprietors have received the full statutory dividend to which they have been entitled. The satisfactory financial position that enabled this welcome change (small though the deficiency in dividend has been) was not the outcome of that enormous increase in consumption which the County Council wiseacres predicted would result, to the detriment of the consumers, from the lowering of the illuminating power of the gas. As a matter of fact, the percentage growth of the consumption was only 1·6 in the half year; and this is entirely traceable to the increased business now being done under the prepayment system—the cash value of this increase being only £2800, as compared with the £11,567 which the consumers took as their concession in connection with the statutory rearrangement of the conditions of supply. In fine, the improvement in the profit is found to be almost completely due to the better state of the residuals market.

But though there has not been a large increment in consumption, the Company have been very busy connecting up new consumers—more especially prepayment—and stoves; and there are no signs of any abatement in this direction. There may be some relation between this great activity in the development of new business and the cheaper capital which the Company are now handling. Whether this be so or not, the extension of custom in the manner that is being effected in the East-end is something which begets a very comfortable feeling among proprietors who look to future stability as well as to present profits. The cheaper capital the Company are now enjoying is also being employed in another direction in improving the prospects. A substantial amount, the Chairman shows, has been expended in the half year with the object of bringing about even greater economies than those that have been achieved in the past; and this capital looks as though it will be as profitable as that which has been spent on purely business extension. Cheap working with dear capital has been one of the distinctive features of this concern under the engineership and management of Mr. H. E. Jones; and many have marvelled as to how it has been done. [Mr. Jones, by the way, much to the satisfaction of the proprietors, appeared before them at this meeting for the first time as a Director.] But the cheaper capital is now enabling the Board and their new Engineer to tread where the predecessor of the latter was to some extent restrained by circumstances from going; and the considerable expenditure that has been made in the half year on steamers for the carriage of the coal from the North, and in improvements at the works, cannot fail to produce the further economies expected of them. On all these and other grounds, the proprietors had good reason for the contentment which characterized the meeting.

The passing of the Company's Bill which gives them relief in the matter of the method by which their gas is tested was mentioned in the Directors' report without comment; but the Chairman (Mr. W. G. Bradshaw) rectified the omission, and gave the proprietors a full explanation of the circumstances under which it was passed provisionally that it should cease to be operative at the end of three years, by which time it is anticipated that any recommendations that may be made by the Departmental Committee of the Board of Trade will govern the testing of gas in the Metropolis. In his remarks, the Chairman actually had a good word to say for the County Council, for which that body should be truly thankful. He regards the course which the Council took in dealing with the Company's Bill as a "reasonable" one; and he has some confidence, or at all events he finds ground for hope, that, when the inquiry is held by the Departmental Committee, the Council will approach the question with a statesmanlike desire not merely to harass the Companies or to get the better of them, but to secure for the public cheap gas suitable for all purposes. It is the devout wish of all with the best interests of the Metropolitan gas supply at heart that there may not be a land-slip anywhere in the neighbourhood of the ground Mr. Bradshaw has found upon which to rest his hope, and that his confidence may be fully justified. We cannot, however, bring ourselves to the same sanguine view as the Chairman. Before and at the beginning of the Committee work of last session, there was an appearance of a little sweeter reasonableness on the part of the Council, and the adoption by them of a more statesmanlike attitude in dealing with Metropolitan gas affairs. But the appearance was not long held up by acts. It was recognized by one eminent gas engineer and politician that it was a statesmanlike act on the part of the Council to propose in a Bill which they promoted the supply of 14-candle power gas to the consumers on the north side of the Thames; but shortly afterwards the Council opposed the lowering of the illuminating power of the Crystal Palace Company's gas. Such capers in policy as these do not impress one as being statesmanlike. However, it may be that Mr. Bradshaw is right. But it is found at times that "coming events cast their shadows before "them;" and if the extravagant statements that were tendered by the Council on the Crystal Palace Bill may be taken as the "shadows" of their proposed part in the events before the Departmental Committee, then even Mr. Bradshaw may at once shatter the hope to which he gave such confident expression on Thursday.

The above do not by any means exhaust the points of interest at the Commercial meeting. It will be seen that the consumers and employees are readily taking a pecuniary interest in the concern; that the Company have scored successes against the electric light in the matter of street illumination (reference is made more particularly to this elsewhere); that the Directors are exceptionally pleased with the manner in which their new Engineer has taken up the reins that his father laid down; that the first recognition at a Gas Company's meeting in London was made on this occasion of the step that Sir George Livesey and his colleagues on the South Metropolitan Board took with reference to the concession for monozite sand; and that Mr. H. D. Ellis brought before the proprietors the important decision that has just been delivered by the Court of Appeal on the question of the liability for forged transfers. This last-named matter is one that has produced some commotion in municipal circles and in the world of joint-stock enterprise. Appeal, however, is to be made to the final tribunal, whose judgment, it is hoped, will reverse that of the Court of Appeal.

Prosperity at Tottenham—Proposed Special Supply for Gas-Engines.

PROSPERITY for some few years has followed the Tottenham Gas Company with remarkable constancy. The past half year has produced for them the abnormal increase of 16·79 per cent., while it has been the common experience that the period has not been one of a character to foster the extended use of gas. Such increases as have been obtained are due almost entirely to new custom; and had it not been

for this, the majority of gas undertakings would have had a set-back. But the Tottenham Company have a district to supply that has been developing at an unusual rate of late years; and there is no sign of any cessation in activity in this regard. In view of this, and an announced reduction of 2d. in the price of gas, the prospect is excellent for a continuance, for some years to come, of the expansion of the business at a rate that a company cannot hope to attain with a district fenced-in and fully developed and populated. If the present rate of increase is upheld, the Tottenham Company will double their output in four years; and, looking ahead, the Directors are contemplating the construction of large new works. They have been delaying taking these in hand as long as possible, in view of the present energy in the production of new retort-house plant. On this head the Chairman (Mr. Corbet Woodall) had something to say to the proprietors on Saturday as to the revival of the vertical retort; and he spoke very approvingly of the new mechanical stoking-machines that have recently been introduced. Altogether, the doings at Tottenham in the near future are likely to invite some special attention in the gas engineering world.

Next to this prosperous condition of things, lively interest will be taken in a suggestion which the Directors and their Engineer (Mr. A. E. Broadberry) have at the present time under consideration, and which, if only for the lessons it will teach, we heartily hope will become an actuality. Within an area not far from the Company's works, are located some 500 gas-engines, varying from ½ up to 100 horse power; and an application has been made to the Directors for a supply of cheaper gas for these engines. If the demand is of such a nature as to justify this special manufacture, Mr. Woodall announces that the Board, on their part, will have no objection to engaging in it. But, after saying this, the belief or doubt that is within the Chairman would work out; and apparently the Directors are determined to settle the point before they proceed further. "One thing," he said, "we shall have to be clearly "satisfied about is that, while furnishing a supply of gas "at a rate per 1000 cubic feet cheaper than the ordinary "supply, it is really cheaper to the user, having regard to "the suitability of the gas for the purpose intended. It "would be a mistake to judge of the gas supply by the "measure of so many cubic feet without taking into con-"sideration what those cubic feet contain." We hope that the engine-users who have petitioned the Company for a cheaper supply for motive power purposes, will appreciate this solicitude for their interests. Anyway, the issue of the Directors' consideration of the subject will be watched for with interest. If they can see their course clear to enter into this special supply, it should have the double effect of encouraging the setting up of manufactories in the district, and of keeping the thoughts of the manufacturers from producer gas.

"Progressive" Views of the Report of the Municipal Trading Committee.

It is not surprising to find that the recommendation of the Joint Committee of both Houses of Parliament on Municipal Trading, in favour of a searching and reliable audit of municipal accounts, has already aroused the alarm and excited the animosity of the more headstrong partisans of this kind of trading. It is a little difficult to understand why, in the absence of an ulterior motive, anybody should take the trouble to declare that the recommendations of the Committee in this regard "must be fought vigorously by "local authorities." What is there to object to in the requirement of sound book-keeping, and an adequate audit? This is the question which will infallibly be raised by the opposition to such a safeguarding of the public interest. The excuse is offered that the auditors employed under the Local Government Board are incompetent quibblers, who report small infringements of the rules of the Department, but neither check extravagance nor discover grave irregularities. In reality, however, what is feared is that the officials will go only too deeply into questions of municipal solvency, inasmuch as the Committee suggest they should express an opinion upon the necessity of reserve funds, and pronounce upon the adequacy of depreciation allowances. "There's the rub!" Municipal traders do not want any official opinions on these points; they prefer to ignore them, as they usually do under the present system.

It is becoming clear, however, that the greatest trouble of the municipalizers in the immediate future will not be anything that Parliament or the Local Government Board may or may not do to their books, but the sudden drying up of the sources of loan capital. Not all the sympathetic newspaper defenders of the Progressive cause in municipal politics will avail to relax the purse-strings of the money-lenders who are not inclined to take any more corporation bonds. This failure to get the necessary money for municipal trading enterprises will do more to quell this ridiculous fashion than all the diatribes that have ever been penned against it. Of course, the innocent must suffer for, and with, the culpable in this respect. Municipalities have proceeded on the assumption that the capacity of the Money Market for absorbing corporation loans was unlimited; and they have had an unpleasant awakening. There was plenty of warning of what would happen. When the earliest municipalities began to borrow on trading accounts, they were surprised and delighted at the cheapness of the loans. Naturally, the example was followed and overdone. For some years past, the more heavily-dipped corporations have had to pay more for their capital than the others. And gradually the greater cheapness of local authorities' capital, which was formerly the chief inducement for their entering into any commercial undertakings, has been giving way to advancing prices, until at last it was recognized that, what with one thing and another, the sound statutory companies could borrow more cheaply than public bodies.

"Hence these tears!" The municipalities have spoilt their own market by reckless commitments, questionable book-keeping, and heedlessness of the future. Many of them are pledged over head and ears to a continuance of the actual order of things, which is by no means part of the scheme of the universe. The Prime Minister has said as much, more than once. It was all in vain. Altogether apart from any trading questions, when it became evident that local government meant paying £500 per bed for accommodating pauper lunatics, it was clear something must be very wrong somewhere. Not knowing whom or what to blame, the Money Market has refused to be party to this kind of thing, by stopping the supplies. The check is almost tantamount to a breakdown of the whole system of local government finance, and is likely to produce various results before the reassembling of Parliament.

Gas and Electric Light Fitting Estimates.

The "Ironmonger" is much exercised over the fairness or otherwise of expecting electric light wiring of interiors to be priced at "per point." It appears that the practice has already extended so far that the idea has been suggested of fixing a standard price for such work at per point, with the object of avoiding underselling by those in the fitting trade in the same town. The motive is laudable; but it is feared the datum of estimating is rather shaky. Of course, the artless electrical fitters who fell in with the "point" system borrowed their notion of this useful generalization from the gas-fitters, who have long adopted it. Perhaps many of them were once gas-fitters themselves, and merely added a fourth "branch" to their handicraft in order not to be left out of the running after the new business. At any rate, these ingenious workmen had the idea that electric light wiring could be quoted for at "per point," which is now disputed. The fact remains that a good deal of business is done on this basis, and that wherever electric lighting is being supplied an estimate for the fitting at so much per point is likewise obtainable. Our contemporary objects that this rule in estimating can hardly be fair for gas-fittings, and it certainly cannot be appropriate to electric wiring. The reason is, of course, that the distance between a lighting point and the starting place for the pipe or the wire is not always the same; to say nothing of the requirements of switches, and so forth. Therefore, the cost of running pipes or wires to points must vary considerably in different jobs.

This criticism is doubtless just; but it overshoots the mark. Estimates of gas-fitting at per point are merely the result of the desire of ordinary people to know roughly what a job of the kind is likely to cost. It is on a par with the architects' rule of "cubing" a building for its average cost, which still leaves room for a good deal of judgment. Every important job of gas-fitting is measured up, and not priced in this rough-and-ready fashion. It is the same with electric wiring. There are jobs which would work out very

remarkably on this basis; as, for instance, the electric lighting of St. Paul's Cathedral, which cost for plant and fitting about £10 per point. At the opposite end of the scale, there is the usual ten-roomed house, the whole cost of building which can be stated (to five shillings) by any speculative builder in the neighbourhood. It would be absurd to question the validity of the point system of estimating for the gas-piping or the electric wiring of such houses. As the size of the house increases, so the estimated cost per point insensibly grows. If it is 9s. per point in the most general type of semi-detached villa residence, it will be a shilling or two more with every additional room. There does not seem to be much real difficulty about the subject. At the same time, it appears that the cost of electric wiring is a very elastic matter; the advertised figures of tenders for such jobs varying most unaccountably—perhaps not more so than the quality of the work, which cannot be so easily tested as gas-piping.

More Phenomena of Radiant Energy.

A SHORT time since, we mentioned some of the more remarkable results that have been achieved by the modern scientific study of radiant energy, which seems to exhibit contemporary science at its very best. This study is still being pursued with the utmost activity by scientific workers of every nation, and it is scarcely possible to say what may be discovered from one day to another. When we last dealt with the subject, it was to comment upon the truly extraordinary nature of radium, and to register the discovery of the N-rays of Blondlot. Something more has since then been learnt of both radiants. Sir William Ramsay, the new President of the Society of Chemical Industry, naturally wanted to ascertain the exact character of the emanation from radium; and accordingly he concerted measures with Mr. Soddy, who was working in his laboratory, to experiment upon this strange form of matter. It was necessary to procure a stock of radium to work upon, which was a costly enterprise, as the stuff fetches more than £25 for a grain. Sir W. Ramsay, however, bought as much of it as he could get—exhausting the market for the time being; and the first result of the examination to which he and his colleague subjected the material was that the emanations contained a quantity of the gas helium. There was no questioning the fact. What this meant, Sir W. Ramsay dared not say. It has since been confirmed with another sample of radium bromide, which gave the spectrum of pure helium with the addition of two new lines. The prospect opened out by this discovery is dazzling. Sir W. Ramsay declares that even now any rich man who did not mind possessing a luxury could furnish a very efficient illumination for an ordinary sized room which would be permanent—or, at least, would last some 3000 or 4000 years—for an expenditure of £500, "if he could get the radium." There must be a cipher or two missing from this estimate!

As regards the N-rays of Blondlot, the latest information is that the increase of luminosity which these radiations cause in an electric spark, in a small gas-flame, and even in an incandescent solid, is not due to a rise of temperature. Here is, in effect, a luminous action unaccompanied by heat, and not apparently connected in any way with temperature effects. This seemingly paradoxical fact has been established beyond any possible doubt by a very extensive series of experiments conducted in various ways. In one case, a piece of platinum wire 1 millimetre thick and 15 millimetres long was brought to a dull red heat by means of an electric current. A beam of N-rays from an incandescent gas-burner, passing through screens of wood and of aluminium, was focussed upon this wire by means of a quartz lens. The brightness of the wire was viewed through a piece of ground glass. On placing a plate of lead in the way of the rays, the luminosity of the platinum wire was sensibly reduced. The same phenomenon was observed with a plate of platinum, heated by a gas-flame, through which a current of electricity was passing. The resistance of this platinum did not change, whether the rays were falling upon it or not; yet an increased luminosity of both sides of the platinum was coincident with the focussing of the rays upon the plate. This went to show that the rays could penetrate incandescent platinum, though they are stopped by cold platinum. All this is very marvellous, and goes to indicate that our customary notions about the nature of matter, and our understanding of such qualities as opacity and so forth, will have to be reconsidered.

The Dieterich Vertical Retort.

An expression of gratitude must be offered to Mr. C. F. Dieterich for his ready response to the suggestion made to him privately, and concurrently in the "JOURNAL," that he should supply for publication what was bound to be the interesting information, why he did not proceed with the development of the form of vertical retort which he invented in 1880, and which bears such a close resemblance to the retort about which good reports occasionally reach us from the Continent. We are extremely pleased that the suggestion was made, because not only has it yielded a reply to our inquiry, but the specifications of a development which goes a large step—whether practicable or otherwise is another matter—beyond the latest proposal in this country, and we are afraid antecedes a development on somewhat similar lines elsewhere. But to deal first with the reason for, practically, the dereliction of the 1880 proposals by Mr. Dieterich. It is simply that (as stated in the remarks prefacing the specifications as published in our "Technical Record") the cry in America in the early eighties for gas of high illuminating power, led the gas companies to turn to carburetted water gas to such a large extent that improvements in coal-gas plant stood little chance of any profitable development in that country. But times have changed, and the high prices of gas oils have induced a return of attention to coal-gas production, Mr. Dieterich fears that the result of this will be—the consumers having become habituated to gas of 20 to 30 candle power—favourable to the electric light. If this should be the experience in America, it will quite differ from this country, where incandescent burners and the spread of heating and cooking by gas has produced the demand for gas of lower illuminating power and price. However, that is not a point for discussion here. The interesting thing is that the belief, as stated by Mr. Dieterich, has resulted in an interesting extension of his vertical retort system, whereby in one run coal-gas is first produced, and is supplemented, in both volume and candle power, by the production, from the incandescent residual coke in the retort, of water gas enriched by liquid hydrocarbons; and the arrangement is such that the mixture of the two gases can be so regulated as to produce a gas of any illuminating power desired. This combination arrangement has not so far been tried on a practical scale; but confidence is expressed of favourable results.

Vertical Retorts for Coal and Water Gas Manufacture.

Though the specifications which describe the combination process to which reference is made in the preceding paragraph bear the name of Mr. C. W. Isbell, it will be seen that Mr. Dieterich has a controlling interest in the patents. No attempt need be made here to describe the construction of the new setting and retorts, nor the means that are provided for the circulation of the gas within and through the heating chamber and around the retorts—the details on these and other points will be gathered from the illustrated descriptions. The principle of the process is simply this—that provision is made for the admission, at the bottom part of each retort, and after the carbonization of the charge of coal, of steam—preferably superheated—which produces the decomposition or combustion and conversion into gas of portions of the coke close to the sides of the retorts. But the economical aims of the invention do not stop there, because we see further that this gas is enriched by the naphtha, benzol, or other hydrocarbons distilled from the tar which has deposited from the charge itself into a receptacle provided for it at the bottom of the retort. The arrangement also permits of the admission of liquid hydrocarbons from an outside source. The fixing of the resulting gas is also accomplished within the setting; a couple of the retorts being set apart for fixing chambers. The steam that is admitted as explained performs a useful function concurrently with the production of the water gas—in fact, used for the one purpose or the other, the double effect results. In these new settings, the gas, instead of being taken off as in the 1880 type from lateral inclined openings at various heights of the charge, is removed from the top. This is going back somewhat to the method adopted in the early forms of vertical retort; but this, it seems to us, is unavoidable in this combination process. However, the gas is allowed free exit by vertical channels in the full length of the interior of the retort; and these channels also permit of the

expansion of the charge. Now the steam effects the loosening and decomposing of the residual coke, so that it has a ready exit on its exhaustion. Such are the principles embodied in this interesting development of the vertical retort. Each setting is a self-contained coal and carburetted water-gas producer; and the uppermost object is the realization of the utmost gas of high candle power from the coal carbonized. There will be one regret—that no results are yet available which have been obtained on a practical scale. If Mr. Dieterich is in possession of any that have been realized only on an experimental scale, they would be received with the greatest interest, and reservation of judgment until confirmed or otherwise. What gas engineers will be curious to know over this side is how much gas in excess of that produced under ordinary conditions can be gained under this process with and without the addition of liquid hydrocarbon from an outside source; the quantities of gas at different illuminating powers; and figures as to the costs of the coal and working expenses—in fact, all the data that trials may furnish from beginning to end. As soon as Mr. Dieterich can supply information of this character, gas engineers here will again be as indebted to him as they are to-day for the present description of an expansion of a process in which interest has been so largely revived.

A Strange Preference at West Bromwich.

It is really difficult to understand the peculiar fascination that some town councillors have for the electric light for public purposes. So long as they can see it in their streets, the question of the best return for the money expended is for a time one about which they do not care a straw. The West Bromwich Town Council are wanting to do something big along a section of the tramway route in the borough; and we give elsewhere an account of the experiments that have been proceeding, and of the struggle that the Electric Lighting Committee have been making to secure the lighting. The performance of the Electricity Department was not a particularly creditable affair, seeing that they had to make two or three shots before they recognized, or could find out, what were the actual requirements of the case; nor did they submit any fixed price per annum for the total lighting until pressed at the last Council meeting to do so—this being some little time after the Gas Department had announced their figures. However, the lighting for the length of the tramway route in question has been given to the Electric Lighting Committee. Why, we cannot conceive, as really it is almost ludicrous to see what they—through the preference of the electricity-struck councillors—are going to give the ratepayers for their money. The Committee have, it appears, worked their price out on a basis that they could not afford to supply any ordinary customer for; and the total comes to £600 per annum. On every alternate central pole on the tramway route will be two of the reputed 1000-candle power arc lamps; and also on every alternate pole, two 25-candle power incandescent lamps. Now the Gas Department take as their number of lighting hours per annum 3940; the Electric Lighting Department, under this contract, have tendered for 3650 hours. There, to commence with, is a loss of lighting for 290 hours per annum. Then the "1000-candle power" lamps are only to be alight for 1460 hours out of the tendered-for number of 3650 a year! For no less than 2190 hours each year the people of West Bromwich are to be content with two wretched 25-candle power incandescent electric lights on every second tramway standard; in other words, a total of 50-candle power (if it is reached and is constant) is deemed to be sufficient by the Electric Lighting Department for lighting 80 yards of roadway for 2190 hours out of the 3650 lighting hours! Well, if the people of West Bromwich put up with this kind of thing long, we shall be surprised. Fancy the change from 2000-candle power (if obtained) per 80 yards of roadway down to 50-candle power! Now what did the Gas Committee offer? Two Lucas lamps of 700-candle power each attached to alternate tramway standards *throughout* the 3940 lighting hours per year for £435; or two 200-candle power double-burner lamps upon every standard for £484—one burner in each lamp in this instance to be extinguished at 11 p.m. Here, in comparison with the electric lighting tender, was a large saving in money; an extension of the lighting hours; and a light throughout the 3940 lighting hours per annum of which the Gas Department would not be ashamed. Who offered the best value for the ratepayers' money?

A Further Study of Incandescent Mantles.

Readers of the "JOURNAL" who follow the proceedings of the American Technical Societies will doubtless remember that rather more than two years ago we gave the text of an interesting paper read at the meeting of the Michigan Gas Association, on "The Relation of the Heating to the Lighting Power of Gases, with Special Reference to Incandescent Mantles." It was prepared by Messrs. Hermann Russell and A. H. White, and embodied results of investigations carried out by them in the Chemical Laboratory of Michigan University. This paper was followed by another by the same authors, in collaboration with Mr. A. F. Traver, on "The Theory of the Incandescent Gas-Mantle," presented to the same Association. A second paper thereon was contributed by Messrs. White and Traver to the New York Section of the Society of Chemical Industry. The earliest studies on these subjects were directed to ascertaining the extent of the influence of the heating value of the gas upon the amount of light emitted, and the conditions requisite for obtaining the highest efficiency with a given mantle. In these investigations, the question of the temperature of the mantle received preliminary treatment; and it was gone into more thoroughly in the communication presented to the Society of Chemical Industry. This very interesting subject has been further considered by Mr. White, this time in association with Mr. M. E. Mueller, with the object of determining the extent of the loss sustained by incandescent mantles when burning. A paper giving the results of their work, so far as it had gone, was read at the meeting of the Michigan Association last February; but, as the experiments were not completed, it was withheld from publication. It has now been distributed among the members, and is given in another part of the "JOURNAL." It will be seen that the authors did not take into consideration the effects of shock or vibration of any sort, which might damage the mantle, but simply endeavoured to find some reason for the slow falling off in illuminating efficiency which takes place during its life. They were convinced that some change must necessarily occur, either in its micro-structure or in its chemical composition; and it was the nature of this change that they studied. The conclusions arrived at are that the physical changes which take place in mantles while burning are relatively unimportant, and that the greatest cause of gradual deterioration is the loss of cerium oxide, which slowly volatilizes in the intense heat. The authors say their experiments do not support the theory of periodic change in the illuminating capacity of the mantle, but confirm the position previously taken, that "the alteration in the heating power of the gas, with its consequent effect on the temperature of the mantle," is the most important factor in causing fluctuations in its illuminating power from one day to the next. They consider that the amount of moisture in the atmosphere also exercises an appreciable influence. It has been suggested that the use of water gas has a deteriorating effect on mantles; but this is not borne out by the experiments.

Mild Weather and Parliamentary Ties at Liverpool.

Circumstances—chiefly the unusual climatic conditions which prevailed during the early months of this year—have been against the Liverpool Gas Company recouping the large reduction in price of 3d. per 1000 cubic feet which they made twelve months since. The increase in consumption was barely ½ per cent., and, owing to the reduction in price, the receipts from gas were £38,211 less than in the preceding year. But this was almost counterbalanced by savings in materials, and presumably by improvements in the receipts from residuals. The result was that £8000 had to be removed from the undivided balance to meet the claims of the year upon the profits. The prospects, however, for the current year are considerably better. Notwithstanding the disappointing result which has attended the reduction in price, it is clear the Directors will not delay a further concession to the consumers immediately a sufficient improvement in their position will warrant them doing so. The Company have the keen competition of a municipal electric lighting undertaking to meet; and it says something for the manner in which they are encountering it when it is found that they have even an increase of ½ per cent. in face of extraordinarily mild weather in the months when a large gas consumption is looked for. The Company also give what is regarded down south as a very high

illuminating power; and there are signs, we fancy, that the Directors do not regard this as an altogether unmixed blessing. Referring to the price of gas, Sir Edward Lawrence stated that "the public should remember that the Company's hands were more or less tied, and that they could not enter into competition as freely as they might otherwise do with those who were engaged in business against them. They were tied by Acts of Parliament, which limited them entirely to the quality of gas they were bound to produce, and also fettered them with arrangements in other ways." Questioned as to whether the Directors had tried to get the illuminating power reduced, Sir Edward replied that they had not; "whether it is to be done in the future or not is another matter." But the costliness of applying to Parliament, and the uncertainty of the attitude the Corporation would adopt in connection with such an application, appear to be the barriers, in the view of the Directors, to an application to Parliament at the present time. The Company's experience of the past year rather suggests to one making an outside survey of the position to supply an excellent case for an appeal to Parliament for some relief from the restrictions under which they are at present working.

The Water Requirements of Gas-Works.

Elsewhere in the "JOURNAL" to-day a paper read at the recent meeting of the Water-Works Association is published and commented upon. It is mentioned here as Mr. Maxwell's paper and the discussion to which it gave rise are not altogether without interest for other users of compressed air—among whom are many gas engineers. Several gas-works, too, now have their own wells for obtaining water; and where compressed air, gas, and steam are available on the works, there may be some doubt as to which system to use. Perhaps in what is published to-day, gas engineers who are or may later on be faced by the problem as to which method of raising water to adopt, may find something which will help them to a ready solution—at all events, in the present state of knowledge.

WATER AFFAIRS.

The Metropolitan Water Board and the Companies' Claims.

THE publication last Thursday morning of the principal features in the answers made by the Metropolitan Water Board to the claims of the two Companies—East London and New River—which stand first for consideration by the Court of Arbitration under the Metropolis Water Act, 1902, when they meet on the 26th of October, created something like a scare; and the effect was a considerable fall in the stocks of all the Companies—ranging, in fact, from 10 to 25 points. In the cases of the two Companies immediately concerned, the East London ordinary stock, which stood rather more than a week ago at 239½, was down on Friday to 210; while the new shares of the New River Company dropped from 430 to 405. When it is borne in mind that these securities were not very long since as high as 248 and 445, the heaviness of the blow they have received will be fully appreciated. In each instance the drop was very serious; and this was only one incident in the general tumble-down of water stocks shown by our Money Article and Share List to be found elsewhere—the "water fall," as facetious gentlemen of the House called it—which was the sensation of the past week in the neighbourhood of Capel Court. It presented a striking contrast to the "boom" which took place in May, when Southwark and Vauxhall ordinary went up 47½—making a total rise of 75 in the course of the year—and New River new advanced 40, with rises of considerable amounts in the cases of the other stocks. When discussing the reason for this extraordinary appreciation, a financial contemporary suggested that it might be due to the expectation of greater compensation from the Water Board, for present or prospective improvements, than had previously been anticipated.

If this was the real cause of the rise, it is not surprising that the announcement of the Board's views in regard to the value of two of the properties they will acquire, had the effect above recorded. From the particulars of the answers which appear on another page, it will be seen that in one case the ordinary stock is not considered as being worth taking over at any price, while in the other a sum of £3,000,000 is offered for property for which the sellers ask £11,666,000—offered, too, with the remark that this amount is more than sufficient to repay the Company the whole of the money they have spent upon their undertaking. Seeing that at the close of the year 1901 the East London Company had expended upon their works £3,688,029, and the New River Company £4,036,794, the offers of the Board are simply preposterous, and such as we should never have thought a public body would have had the effrontery to seriously put forward. We venture to assert that not a single business man on the Board would consider such proposals just and equitable if they referred to his own undertaking.

We do not, however, for one moment, support the claims of the two Companies. They may be excessive or they may not. Those who were entrusted with the drafting of them had a perfect right to put a high value upon property which is returning its owners good interest, and which is being compulsorily taken out of their hands. But for the advisers of the purchasers to make such an astounding proposition as the wiping-out, without compensation, of a large amount of capital which has been subscribed to enable the public to be supplied with one of the most important necessaries of life, is to suggest an act of spoliation such as we trust will never be committed. We have sufficient confidence in the tribunal who will have to adjudicate upon the Companies' claims to feel assured that they will hold the balance as evenly as possible between the two parties to the bargain they will have to settle, and that while, on the one hand, they will not accept as gospel all that the sellers of the properties say in regard to their value, they will, on the other, treat as they deserve the attempts of the buyers to depreciate it. Such attempts are, unfortunately, only too conspicuous features of the answers just sent in. It is one thing to roundly assert that the sources of supply of the two Companies to whom they refer are practically exhausted, and quite another to prove it to the satisfaction of the Court of Arbitration. This, however, the Board will have to do before they will get a hearing for what we cannot but think will be generally regarded as most iniquitous proposals.

Raising Water by Compressed Air.

THERE were two discussions of extraordinary length at the annual meeting of the British Association of Water-Works Engineers; and one of them was on the paper by Mr. W. H. Maxwell, of Tunbridge Wells, in which he treated in a very practical manner the question of raising water from deep wells and borings by compressed air. The topic is one of current and growing interest. But the fundamental principles which govern the system appear still to be somewhat obscure, and so little understood; and the efficiency of operation, experience indicates, is subject to, and affected by, such trifling alterations in conditions, that on all grounds fuller inquiry, experiment, and relation of results ascertained in actual practice are called for. All this was shown by the paper and discussion which Mr. Percy Griffith produced at the recent Engineering Conference in London; and it is emphasized very strongly by the protracted discussion to which Mr. Maxwell's communication gave rise at the meeting of the Water-Works Engineers. This paper, imparting as it does particulars from the constant working of the plant at Tunbridge Wells, will be regarded as of exceptional value. The publication of such details as we have here, and the precise statement of the normal working conditions and results, will do much in contributing to the more exact knowledge of the system that is very necessary before it can be predicted, with any degree of certainty, that it is going to make any great headway in this country.

Although the author speaks highly of the air-lift plant that is in operation at Tunbridge Wells, he is very emphatic on the point as to the necessity for the circumstances being suitable to derive from the plant that efficiency in working which will justify its adoption. Several speakers in the discussion were in accord with him in this regard. This being so, it follows that very careful consideration must be given by engineers to every individual case before determining upon the installation of a plant of this description. And that is not all. Inquiry must not stop at the existing conditions, but must be extended to the prospect of those conditions being fairly continuous. The fact that they may be favourable at the time of installation, is no guarantee that

they will be maintained thereafter. Indeed, it is unnecessary to point out, there is no part of a water-works undertaking having wells and borings for the source of supply in which lurks more uncertainty than in the wells and borings themselves; and if the irregularities to which both wells and borings are subject will affect the working efficiency of the air-lift plant to any appreciable extent, then there is a factor which should not be neglected in the consideration of the question of its serviceable adoption.

Connected with the points of suitability of conditions and efficiency is that of cost. An illustration of the situation which lends itself advantageously to the adoption of the compressed-air lift is sketched towards the close of Mr. Maxwell's paper; but, even under such favourable conditions, the author cannot deny that the cost of fuel involved "exceeds "that required with the steam or oil driven pump of the ordi- "nary form." Granting, however, that there are incidental savings which counterbalance this excess cost, and accepting all that is said that is creditable to the system, until there is fuller knowledge in regard to it, and more assurance as to the dependence that can be placed upon it both at the time of installation and subsequently, it must be confessed that we should, under the circumstances which commend themselves as peculiarly favourable to the air-lift, feel rather more reliability in the gas or oil engine and an ordinary borehole pump, the working cost of which compares very favourably with the compressed-air system. This paper and the one by Mr. Irwin (which was published in the "JOURNAL" for Aug. 4) should be read together in considering this question of expense, because the engineer ought not, before tying himself to the air-lift plant—experience with which has not been so uniformly favourable as at Tunbridge Wells)—to omit consideration of the simple and economical method of obtaining pumping power by means of gas or oil in situations that cannot be dealt with by his existing pumping-station. Still the air-lift plant, with an improvement in knowledge and working may in future justify itself on all points; but the time for doing that, it is clear, is not yet.

The Metric System of Weights and Measures.—The Secretary of the Decimal Association (Mr. E. Johnston) stated in a letter to "The Times" on Wednesday, that on the 9th of June the House of Representatives of the Commonwealth of Australia passed a resolution to the effect that it is desirable that the metric system of weights and measures should be adopted with the least possible delay within the Empire.

Experiments with Sulphate of Ammonia at Cork.—A large area of ground has been set apart within the Cork International Exhibition for the practical illustration of the growth of various crops, and the effects of different manures upon crop-growing. The intention is to enable the Irish agriculturist to determine what his soil is best capable of growing, and how to treat it to obtain the greatest return. One plot makes it evident that the tobacco plant may be grown so as to yield a heavy leaf; another that a vigorous growth of Indian corn may be raised, to be used in feeding cattle; and another shows the cottager how, from his garden, he may obtain as much buckwheat as would nourish bees in summer and feed a large brood of fowls in winter. Near the centre of the area is a piece of ground which has been given up to the Earl of Rosebery, who has presented to the Exhibition Committee various crops, with a view to illustrating the advantages of manuring with sulphate of ammonia. For a number of years, extensive agricultural experiments have been conducted on his Lordship's estate of Dalmeny, near Edinburgh, under the supervision of Mr. John Hunter, F.I.C., F.C.S., who is Consulting Chemist to the Sulphate of Ammonia Committee. Mr. Hunter has selected for the Exhibition the varieties of potatoes, turnips, grasses, and cereals which have been demonstrated to be the most prolific and at the same time least affected by disease. A centre walk runs through the plots; and the sowing has been arranged so that on one side of the walk the crop is grown without, and on the other side with, sulphate of ammonia. It requires but one glance to show the enormous advantage which is obtained by manuring with sulphate. As to the potatoes, the growth above-ground is much more rank with sulphate than without; but, of course, the yield of tubers cannot be ascertained until the crop is dug and weighed. With the other crops it is different. In the case of turnips, not only can it be seen that the tops are much more luxuriant in growth, but also that the bottoms are quite double in size, where sulphate has been used. The grasses which were sulphated are fully one-half better; and the cereals, which have got sulphate are closer and more rank, and carry a much heavier head than those which have not. It will be some weeks yet before the crops are reaped; but when this is done, a detailed report upon them is to be prepared for the Sulphate of Ammonia Committee by Mr. W. M. O'Friel, of Dublin, who is in charge of the ground.

ESSAYS AND REVIEWS.

FALLACIES, FANCIES, AND FACTS.

DURING the past week, several matters touching upon the questions of the competition of gas and electricity and the supply of cheaper gas in London have come to the surface, to which it may be of some advantage to a wider circle of readers than those immediately concerned to devote a little special attention. The whole of them grow out of electrical officials' hypothetical arguments, fallacious statements, and wilful disregard of the existence of a stronger competitor than the flat-flame gas-burner, and of the London County Council's attacks on the supply of cheaper, or lower illuminating power, gas. There has been a lot of senseless talk over these questions by men from whom something different might have been expected. Their fallacies, fancies, and misleading statements unfortunately have not been confined within the walls of Parliamentary Committee-rooms, the halls of technical societies, or even the columns of the Technical Press, but have reached the channels of communication with the general public; and many innocent scribes of the daily press have been induced to write with an air of superior knowledge of subjects about which they really possess as much personal cognizance as the man in the moon. A writer who is cozened into giving publicity to these things is an object of pity among those who have the knowledge that is not his, and very often, we are afraid, the object of the secret derision of those who succeed in tampering with his ignorance for the purpose of furthering their own ends. They know full well there is a large section of the public who take as gospel all that is written and published in the newspapers; and, this being so, their false and plausible statements find an amount of credence which must be harmful to others.

Some of the representatives of the electrical interests are not above a little hyperbolizing in the ears of the daily newspaper man when they get the chance. A case in point is found in the "St. James's Gazette" on Monday last week, under the heading of "Reducing the Price of Gas." It is called a "special interview;" and it purports to be with an official of an Electric Light Association in South London. All we can find "special" about the interview is the deception it contains; and consequently we are not astonished that the name of the interviewed official is not to be found anywhere in the column which is devoted to the balderdash imputed to him. The interview came about through the announcement of Sir George Livesey that the South Metropolitan Gas Company have in view a further reduction in the price of gas. This declaration has apparently caused some uneasiness in the little electrical world of South London; for the unnamed electric lighting official seems to have been glad indeed—in the absence of a similar announcement of a prospective reduction in price for electricity—to have the opportunity of getting a free advertisement for his own commodity, of impugning the good faith of Sir George Livesey in his statements, and of showing, in a disingenuous manner, that electricity is the cheaper illuminant. The whole account of the "interview" is amusing to one who knows; but it is to be regretted that the "St. James's Gazette" has upon its staff a member who is so gullible as the one who had this interview with the electric light official who has not the courage to give his name to the public.

This official eloquently characterizes as "bogey" the statement of Sir George Livesey that the South Metropolitan Company do not mind the consumer burning less gas than of yore, and that they object to their consumers burning gas wastefully. Now we can assure the innocent member of our contemporary's staff that this is a positive fact; and that it is one of the peculiar business methods that most gas companies have adopted to keep at a respectful distance any pressure on the part of competitors. South London is a particularly good instance of its admirable success, as may be seen by an inquiry into the Company's progressive prosperity. Yet—bear in mind the statement of Sir George is all "bogey"—the same official tells this newspaper man that "the Company now supply burners and gas-stoves on hire, and even *real gas-saving* devices;" but for this considerate treatment, and even for the reductions in price, the consumers have (of course according to the electrical official) to thank the electric light companies. There is very little harm done in the publication of such rubbish as this; but it is the dissemination of the deceptive statements which follow that may influence the unwary gas consumer. "Between 6d. and 3d., according to circumstances," says the electrical informant of the willingly receptive "Gazette" man, "is the charge per unit for electric light. Electric light at 4½d. per unit (to strike the happy medium between these prices) is equivalent to gas at 2s. 3d. per 1000 cubic feet. The electric lights, however, are 16-candle power—thus giving the consumer an extra 2-candle power over the gas for the same outlay." Of course, this all refers to South London; but the latter part of the statement is not particularly perspicuous. Now it was, we suppose, altogether beyond the capacity of the interviewer to see, first, that the electrician took advantage of his ignorance, and made his comparison with gas consumed in a flat-flame burner, ignoring altogether the existence of the incandescent gas-burner; and, secondly, that even with flat-flame burners the equality of the prices named exists more in imagination than in

fact. The account of the interview closes with three "facts" said by the "Gazette" writer to emanate from Mr. A. E. Garwood. We propose to take the first of these "facts" in order to prove the hollowness of the statements which precede them, and of which the above comparison is a sample.

Now, Mr. Garwood says that "one unit of electricity will keep 33 10-candle power lamps alight for one hour." Therefore we have this, that for one unit of electricity 330-candle power can be obtained for one hour; and this unit of electricity (taking the figure of the unknown electric lighting official) costs 4½d. Now with the ordinary incandescent "C" burner, a duty of 18 candles per cubic foot of gas can be realized; so that with less than 20 cubic feet of gas used in five or six incandescent gas-burners, the illuminating power of 330 candles can be secured by the consumer. At 2s. 3d. per 1000 cubic feet, 37 feet of gas can be purchased for 1d.; and therefore the 20 cubic feet of gas to secure the same illuminating power that can be obtained, according to Mr. Garwood, from a unit of electricity will cost but a fraction over a halfpenny. Where does the electrical official's middle figure of 4½d. stand as an equivalent of gas as an illuminant at 2s. 3d.? This shows that, to compare with incandescent gas-burners in the South Metropolitan district, electricity must come down in price to below ¾d. per unit—that is, accepting the statements published in the "St. James's Gazette." Now, how does the same computation apply in the case of flat-flame burners. To give it a low value, we will say that 2½ candles can be obtained per cubic foot of 14-candle gas by means of the flat-flame burner. Then to get Mr. Garwood's 330-candle power for the unit of electricity, 132 cubic feet of 14-candle gas would have to be consumed; and this, at 2s. 3d. per 1000 cubic feet, would cost (say) 3½d., as against the 4½d. suggested by the South London electrical official, between whom and Mr. Garwood there is indisputably something radically wrong.

Coming, however, to facts. We have before us a letter from a consumer of both gas and electricity, who has not even the interest of being a shareholder in an undertaking dealing in one or other of these commodities; and it is something in favour of his testimony as to cost to be able to say that he has a sufficient liking for electricity to regard the higher expense with indifference. Now this consumer states that, from careful tests he has made, he finds that about 28 units of electricity are required to equal 1000 cubic feet of gas, consumed in a "C" incandescent gas-burner; and his meters show him that an 8-candle power electric lamp can be used for five hours for 1d., a 16-candle power lamp for three hours for 1d., and an incandescent gas-burner six hours for 1d. The price of gas is 2s. 6d. per 1000 cubic feet, and electricity 6d. per unit. Now let us examine these figures a little, in view of what has already been stated in connection with the "St. James's Gazette" interview. Mr. Garwood, in his "fact," stated that an illuminating power of 330 candles per hour could be realized with incandescent lamps by the expenditure of a unit of electricity. It is some satisfaction to find that our correspondent's figures work out to a point which shows that, in this particular statement, Mr. Garwood has not been guilty of much exaggeration—in fact, the difference is so small that it may be disregarded. A 16-candle lamp can be kept in use for three hours for 1d. Therefore, eighteen 16-candle lamps can be used for one hour by the expenditure of a unit of electricity (costing 6d.) which is equal to an illuminating power of 288 candles for the hour. This is sufficiently close to Mr. Garwood's figure to give reliance in our correspondent's other figures. Now, supposing we take, as a low estimate, that, on an average, our correspondent obtains with his "C" incandescent burner (the gas in his district is of 15-candle power) an illuminating power of 48 candles, and he can use this burner six hours for 1d., we find that he can obtain an illuminating power, by this means, and by employing six burners, of 288 candles for a penny per hour, as against the 6d. which he is called upon to pay for obtaining an equal amount of illumination by electricity. Thus, comparing, on the illuminating power basis, the cost of electricity in his case with the gas used in incandescent gas-burners, it is six times more; and 2s. 6d. × 6d. = 15s., which is 1s. in excess of the cost which he himself admits in stating that 28 units of electricity (at 6d. per unit) equal 1000 cubic feet of 15-candle gas (at 2s. 6d.) burned in an incandescent gas-burner. Instead, therefore, of electricity at 4½d. equalling gas at 2s. 3d., we find that (from this experience of an ordinary careful consumer) 2s. 6d. worth of gas (1000 cubic feet) burned as it should now be burned, for the purpose of illumination will do as much for a consumer as 15s. worth of electricity at 6d. per unit. We should like to hear what the "St. James's Gazette" interviewer has to say to these figures. An ounce of disinterested practical experience of this kind is worth a good many pounds of the advertising bunkum of an electrician who is not above making comparisons with the worst and wasteful use of his competitor's commodity.

On this point of cost, attention may also be directed to some statements made by the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), at the meeting last Thursday, as to the public lighting by gas and electricity in their district. The report will be found in our "Miscellaneous News." The Stepney Borough Council is one of the Local Authorities in the Company's district; and they have their own electric lighting installation. Mr. Jameson is their Borough Engineer; and he has reported to the Council that incandescent electric lamps to give the same illuminating power as the incandescent gas-burners (he deducted, by the way, about 40 per cent. from the value the Gas Company place upon their illuminating power) the Company propose to supply them with would cost about three times more. This is indeed "strong testimony," as Mr. Bradshaw puts it, from an independent engineer. We think that sufficient has been said to show the absurdity of publishing such statements as the "official of an Electric Supply Association in South London" succeeded in getting into our evening contemporary by imposing on his ignorant interviewer.

Now there is the other matter as to the supply of cheaper, or lower illuminating power, gas in the Metropolis. The fallacy that this has been permitted by Parliament in South London to the hurt of the consumers, by causing them to consume a larger quantity of gas, has been exploded by the actual experience of the South Metropolitan Gas Company; and confirmation has now been obtained from the East-end of London. In the session of 1902, the Commercial Gas Company obtained parliamentary sanction to the reduction of the illuminating power of their gas from 16 to 14 candles. What has been the result? In the past half year, the consumption of gas was more by 22½ million cubic feet than in the corresponding period of 1902 when 16-candle gas was supplied. This is only equivalent to 1·6 per cent.; and this small increase is due, the meter registrations show, entirely to the expansion of the coin-meter system. Had it not been for this, there would have been a small decrease in consumption—notwithstanding the reduction of illuminating power. Now where is the County Council's 30 per cent. injury to consumers that they predicted the lowering of the illuminating power would inflict?

But while the Local Authorities, headed by the County Council, are making extravagant statements of this kind, we have a writer in the "Daily Telegraph" yesterday week urging that what is wanted to ameliorate the atmospheric conditions of London in the winter time is a cheap and plentiful supply of gas for house-heating. He recognizes that already, in consequence of the use of gas-fires, "our choking pea-soup fogs are rarer and less deadly than they were of yore." This acknowledgment of the contribution the Gas Companies have made in rendering London more salubrious in winter should be taken seriously into consideration by the Local Authorities before they oppose further proposals which would tend to greater improvement in this respect. The writer of the article sums up the position thus: "The domestic fire-grate has been, and can still be, more improved; but it can never conceivably consume coal otherwise than with enormous waste and atmospheric pollution. Electricity is too dear. There remains the extension of the partially begun reform; and this reform, with heating gas at its natural price, would soon be here." The writer rather favours the idea of a dual supply of gas—one for heating, the other for lighting purposes. But if he studies the course of gas legislation in the past few sessions, he will find that some of the gas companies are doing their best, in the face of remarkable opposition, to strike the happy mean which will give what is required in regard to price and quality for all purposes.

ELECTRIC LIGHTING MEMORANDA.

The House of Lords and the City of London Electric Lighting Contracts—The Law and its Construction—Councillor Kennedy, of Glasgow, on the Future of Gas and Electric Lights.

It sounds like an echo from the ancient past, to hear that the House of Lords lately delivered judgment on the appeal as to the validity of the City of London electric lighting contracts. The original cause of action arose in the dimly distant days when there was no possibility of floating by ordinary means a company to take on the electric lighting of the City; and it was deemed expedient to get up a Syndicate, under the patronage and with the support of the Lord Mayor, to enter into contracts with this object. The contracts were duly made, and eventually assigned to the existing City of London Electric Lighting Company. There was neither secrecy nor anything approaching fraud in the whole arrangement; but, unfortunately, the transaction was illicit, under the terms of one of the City's Acts, which voids any contract entered into by the Commissioners of Sewers in which a member of the Corporation is interested. Accordingly, in 1898, the Corporation, acting on legal advice, repudiated the contracts—not that there was any objection to their substance, but simply because of their invalidity. It was felt that the Corporation would be in a false position if they continued to treat the contracts as valid, knowing them to be otherwise. The Judge who was first called upon to deal with the matter, Mr. Justice Farwell, tried to see whether the Act of Parliament cited is clear, or whether it is fairly susceptible of two constructions. He was of opinion that the Act is perfectly clear, and only susceptible of one construction; and in this view the Judge is supported by the House of Lords.

Mr. Justice Farwell, however, hit upon an extremely subtle and ingenious way of looking at the Act, in which he saw the possibility of holding the contracts to be valid. This was to make a distinction between what he called contracts for construction purposes, and others. The poverty of language here requires us to use the same word in two different senses. When Mr. Justice Farwell spoke of "construction" contracts being outside

the Act cited, he was thinking of the execution of works and the supply of materials to the Corporation in the ordinary way of business, by firms in which members of the Corporation might have an ordinary financial interest. He was undoubtedly justified—in right and reason—in thinking that it would be absurd to hold the Corporation of London debarred from having a contract for the construction of necessary works, or the performance of necessary services, such as the supply of electricity or gas for lighting, with a public company in which an alderman or a common councillor might be a shareholder. The Lord Chancellor said the same. But, unfortunately, it is the law. There is no getting over the stringency of the wording of the Act; and therefore the Lords were constrained to pronounce the contracts invalid, though with confessed reluctance and with hearty regrets. It is not often that a Lord Chancellor uses such unreservedly condemnatory language of the law he is compelled to administer. This time Lord Halsbury was as scornful of the law as Bumble himself; but it goes, notwithstanding.

At the recent meeting of municipal electricians, a somewhat striking statement was made by Councillor Kennedy, of Glasgow, concerning the experiences of the Corporation of Glasgow with gas and electric lighting. He said that the Electricity Committee of the Corporation were astonished to find that their incandescent light could not compare with the incandescent gas-burner. After spending more than £1,250,000 on electricity for lighting, it was Councillor Kennedy's opinion that in future it would be necessary to look more to other uses of electricity. In Glasgow, at any rate, the Corporation are "in serious doubt" whether electricity or gas will be the main source of light in the future. Seeing that they have both strings to the municipal bow, they are quite safe in either eventuality. After all the vapouring that has gone on in electrical circles about the light of the future, this cool statement from the Mercantile North is quite refreshing. Mr. Chamen, the Electrician to the Corporation, was a bit upset by his Councillor's frankness, for which he was wholly unprepared. He remarked that Mr. Kennedy had taken the meeting "off the road," as there was no intention in the paper which provoked the observation, to go into any comparison with gas. Probably not. But there the thing was; and in testifying as he did, Councillor Kennedy was but saying what was uppermost in his mind.

The truth of the matter is that when electricians talk about gas lighting in comparison with their own productions, they never by any chance admit incandescent gas-burners into their purview. We can safely aver that during the past few years hundreds of electric light circulars have passed under our notice. But we might offer a substantial prize to the discoverer of the first official publication of this kind which makes incandescent gas lighting the basis of any comparison with domestic electric lights. Electricians are all Podsnaps in this regard. They decline to recognize the existence of incandescent gas, except when they are pleased to treat it as a rival of arc lights, when they bring out some very remarkable comparisons indeed. Of course, the public are not deceived by this somewhat infantile trick of the electricians; and when it comes to cash for lighting effect, everybody knows that (as Mr. Kennedy, of Glasgow, says) electricity is completely out of it, with incandescent gas available. Still, it was rather unkind to disturb the minds of municipalized electricians in this heartless style.

After the manner of his nation, Mr. Kennedy was careful to rub in his point. He told his auditory that it was well that they should know precisely what was the opinion of Glasgow on the subject—an opinion which has cost £1,250,000 to procure. The information is worth the money. There will be, let us hope, plenty of occupation for all the electrical engineers who, having during the last ten years amused themselves with predictions of the imminent destruction of the gas industry, now find it expedient to drop the prophetic mantle and get to work upon something likely to pay immediately. There is room enough and to spare in the world for electric lighting and gas, as we have always endeavoured to maintain in these columns. Perhaps our good friends the electricians will acknowledge that it is weary waiting for the shoes of dead and unemployed gas engineers, and that it will be pleasanter for the two industries to live together, now that Glasgow, in the person of Mr. Kennedy, has spoken on the subject. Besides, the 1¼ millions expended have not merely gone to adorn a moral and point a tale. The money will carry the people about in tramcars to do their shopping and pay visits by the light of cheap gas.

Mr. A. H. C. Hines, of the Cambridge Water-Works Company, has been elected an Associate Member of the Institute of Mechanical Engineers.

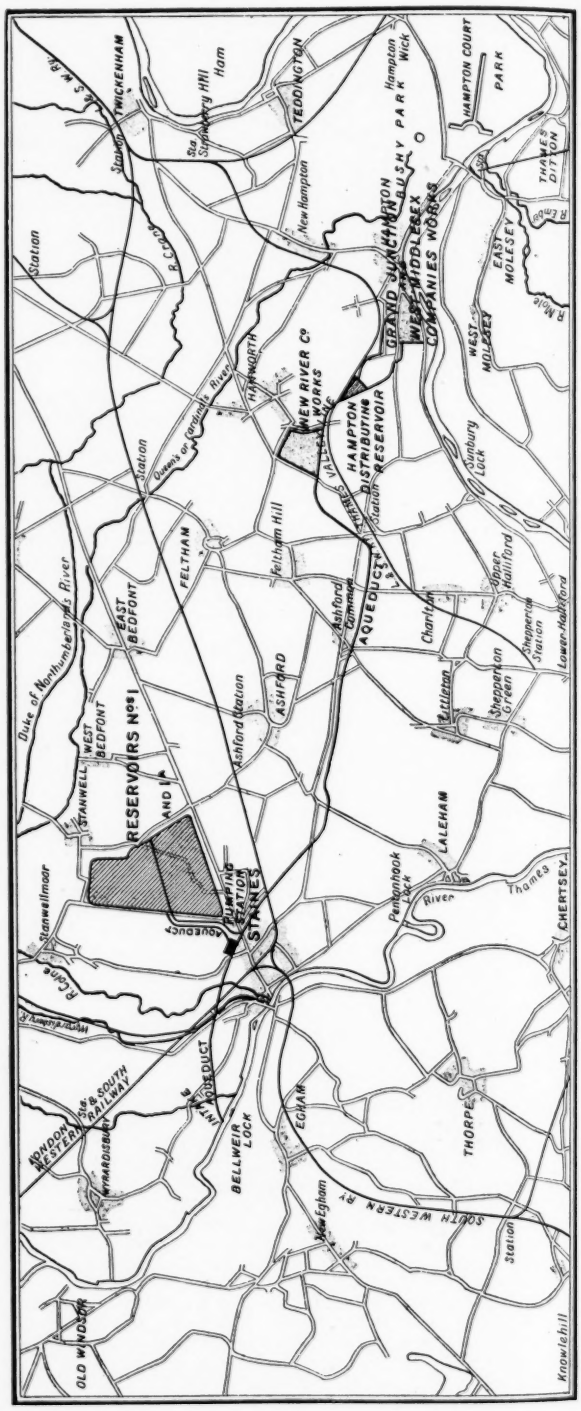
Mr. C. Foster Veevers has been appointed Secretary of the Northfleet and Greenhithe Gas Company, Limited, in addition to the position of Manager, which he has held for five years.

At the annual meeting of the Institution of Mining Engineers at Nottingham, from the 2nd to the 4th prox., Mr. R. Pearson will read a paper on "The Discovery of Natural Gas in Sussex."

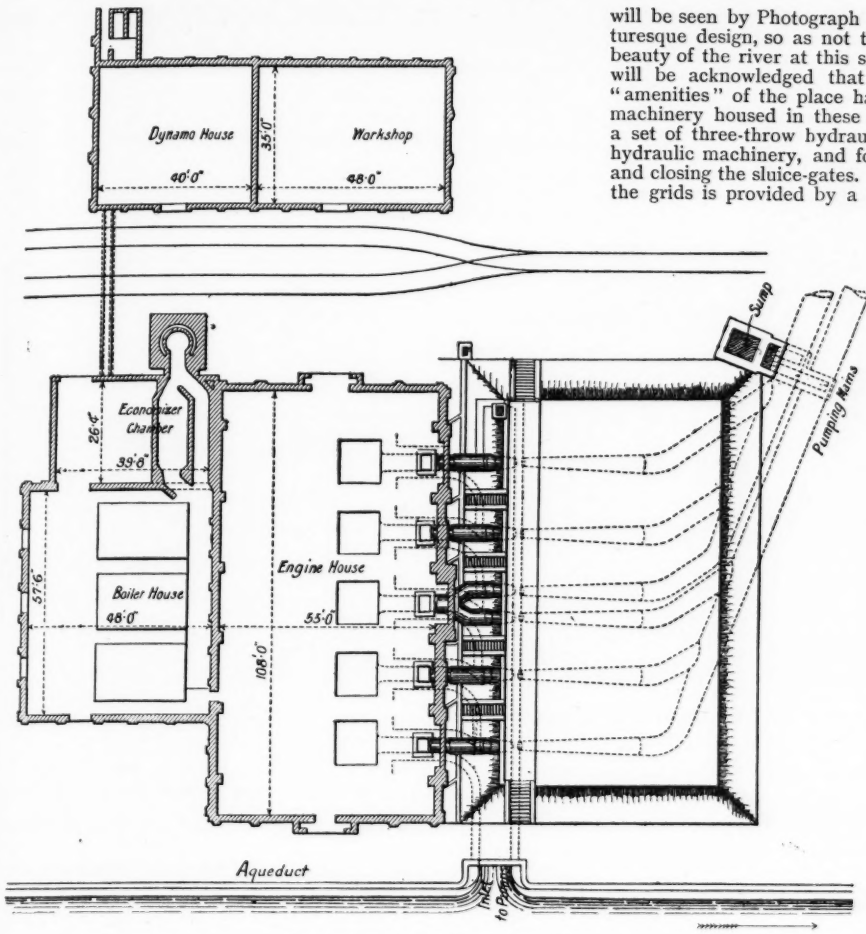
Mr. T. J. Carlton, of Iola, Kansas, has patented in the United States a composition for protecting the walls of retorts, &c. It consists of plumbago, 25 lbs.; burnt fire-clay powder, 10 lbs.; saltpetre, 1 lb.; and cobalt, 25 oz.—the whole to be mixed with 15 gallons of water.

THE STAINES RESERVOIRS.

When noticing, in connection with the proceedings at the Engineering Conference held in London a short time ago, the visit of a party of the members to the new reservoirs at Staines, some additional particulars of these works, with illustrations, were promised. These, by the courtesy of the Engineers (Messrs. Walter Hunter and Reginald E. Middleton, MM.Inst.C.E.), we are now in a position to give. It is unnecessary to recount the



circumstances which led to the carrying out of these works. It may be mentioned, however, as indicating their extent, that they provide storage for 3338 million gallons of water, and will supply, when brought into use, an additional 35 million gallons daily to the Metropolis. This bulk of water will be divided equally between the three Companies who are represented upon the Staines Reservoirs Joint Committee—viz., the New River, West Middlesex, and Grand Junction. In the following description, the course of the water will be traced from the intake to the

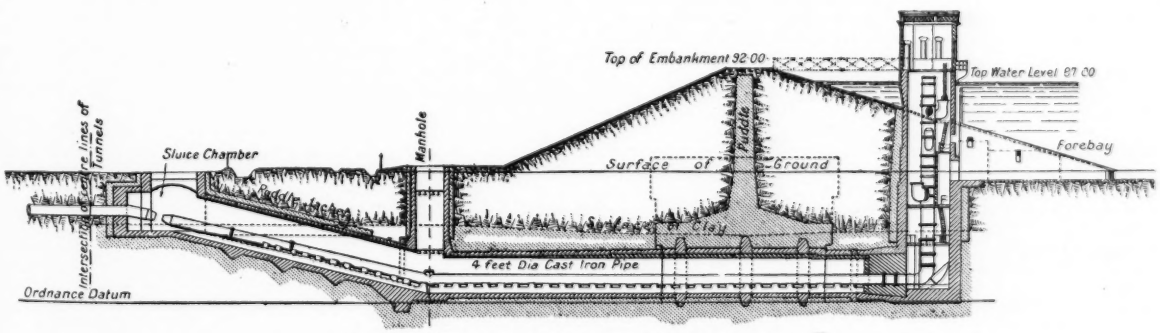


PLAN OF THE PUMPING STATION.

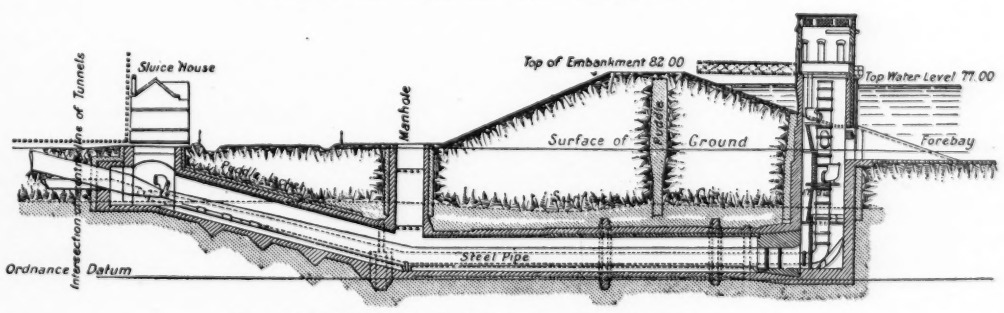
points of delivery in the works of these Companies, as shown on the accompanying map.

THE INTAKE AND CONDUITS.

The intake is situated in Bucks, on the northern side of the Thames, at a point about 300 yards above Bell Weir. Here have been erected buildings to contain the necessary machinery and provide accommodation for the attendants in charge of it. It will be seen by Photograph No. 1 that the houses are of a picturesque design, so as not to give cause for complaint that the beauty of the river at this spot has been marred. We think it will be acknowledged that what in Scotland are called the "amenities" of the place have not been interfered with. The machinery housed in these buildings consists of a gas-engine, a set of three-throw hydraulic pumps, an accumulator for the hydraulic machinery, and four hydraulic cylinders for opening and closing the sluice-gates. Water, under pressure, for washing the grids is provided by a small centrifugal pump, which may also be used for pumping out the sluice chambers for purposes of repair. The straining appliances, shown in the photograph, consist of a semicircular grid with upright bars placed about $\frac{3}{4}$ inch apart. Behind this, at a distance of 4 feet, there is a second grid in duplicate, with smaller meshes. These two strainers effectually exclude everything that might prove objectionable to the water or injurious to the pumping machinery. When the water has passed through the sluice-house, it enters a short length of open channel, and then passes into a double tunnel, each 8 ft. 3 in. wide and about 350 yards in length. On issuing therefrom, it enters what is called the large conduit, which is 8 ft. deep and about 15 ft. 10 in. wide at the top, the depth of water being 6 ft. 4 in. This channel is not continuous to the pumping-station, as certain obstacles were encountered in the course of its construction. In the first place, the Colne Brook had to be negotiated. This was effectually done by means of two steel syphons, 60 feet long, embedded in concrete, and having a curve of 54 feet radius. Then came the lines of the Great Western and London and South-Western Railways, beneath which the water was conveyed once more in double tunnel. This was a troublesome piece of work, as it had to be carried on not only without interrupting the traffic, but in ground which was full of water; and, moreover, the Wraysbury River came between the two lines. All obstacles were, however, overcome by the Engineers and their Assistant on the works (Mr. Duff). The water is conveyed under the Wraysbury and Colne Rivers in steel syphons, as in the other case, and then flows on uninterruptedly to the end of its first journey—the pumping-station, with which the large aqueduct is connected by a tunnel. The channel is then reduced to smaller



SECTION OF THE UPPER RESERVOIR EMBANKMENT.



SECTION OF THE LOWER RESERVOIR EMBANKMENT.

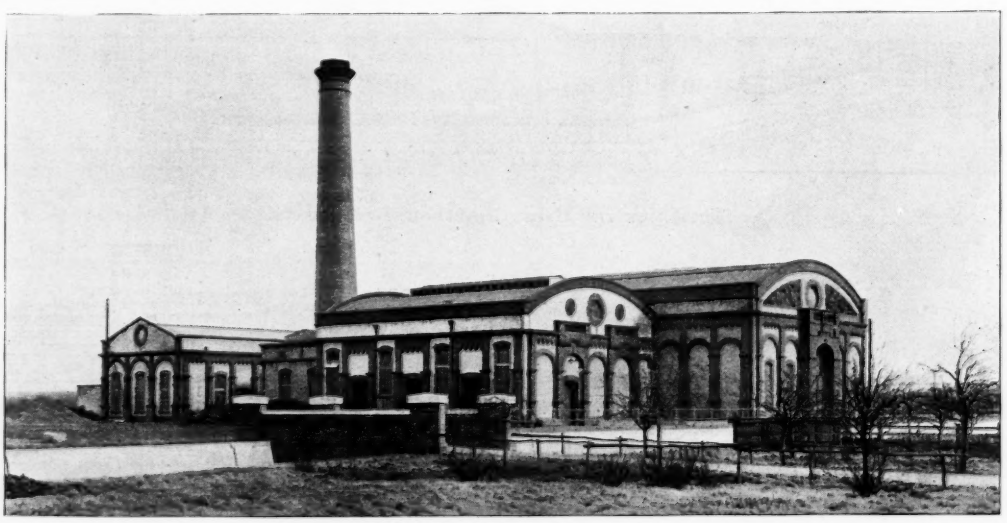
PHOTOGRAPH NO. 1.—SLUICE-HOUSE AT THE INTAKE.

dimensions (11 ft. 3½ in.), and a Stoney sluice placed between the two. When this is opened, the water can be delivered by gravitation from the intake to the receiving reservoir at Hampton, situated about 5½ miles from the pumping-station. At every 30 feet of the length of the conduit are placed expansion joints, constructed of brickwork, bonded and laid in asphalte.

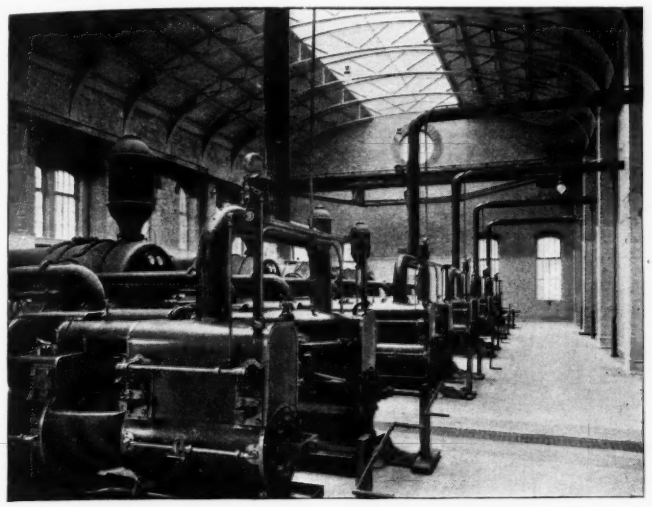
Before leaving this part of the work, it should be mentioned that the "obstacles" above referred to were by no means the only troubles which had to be dealt with; several small streams having to be led under the larger conduit in brick and concrete tunnels. The ground passed through consisted of gravel, ballast, and sand, interspersed with peat; and water was met with in such quantity as to render continuous pumping necessary in certain places, more especially where the railways were being crossed. In only a few cases, however, were deep excavations and large concrete fillings found to be necessary.

THE PUMPING-STATION.

Having followed the water in its course from the intake to the pumping-station, we have now to describe the plant by which it is there dealt with. This is contained in the group of buildings shown in Photograph No. 2; and the general arrangements will be understood better by reference to the accompanying ground plan than by any detailed description. There are nevertheless some features to which attention may be specially drawn. The engine-room, which is 108 feet long and 55 feet wide, is lofty and well lighted, and is spanned by a 10-ton electrical travelling crane. It contains five sets of double triple-expansion horizontal condensing Worthington pumping-engines, made by Messrs. James Simpson and Co., and shown in Photograph No. 3. They draw the water from wells connected by branch tunnels with the one leading from the large aqueduct (the inlet is indicated on the plan); and each one can be isolated by a sluice-valve and pumped dry if required. The engines work at a steam pressure of 150 lbs. per square inch, and make 28 strokes per minute. Their cylinders are 11, 18, and 29 inches in diameter, with a 30-inch stroke; and each engine, with its 35-inch double-acting pump, is intended to put 16⅔ million gallons of water daily into the reservoirs, the lift being about 40 feet at top water-level. The suction-pipes are 54 inches, and the delivery-pipes 48 inches, in diameter. In the boiler-house are six Babcock and Wilcox boilers, each of 110 nominal horse power, with superheaters, one of Green's economizers, a fan for producing forced draught, and a feed-water heater (see Photograph No. 4). Forming part of the group, but separated from the engine and boiler houses by lines of rails connecting the buildings with the South-Western Railway, are the workshop and dynamo-house. The latter contains a steam-driven dynamo, and a complete set of electric recording instruments, showing at a glance the level of the water in the reservoirs and aqueducts, the quantity pumped into the reservoirs, and the quantity passing down the conduits, and taken at various points on its course by each Company entitled to it. These recording

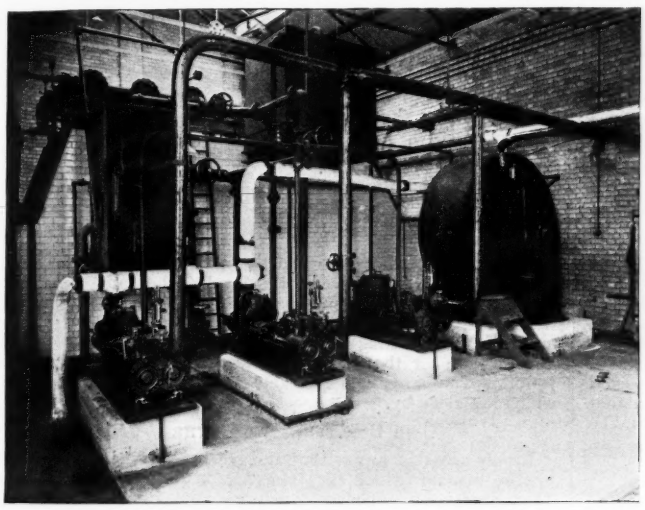


PHOTOGRAPH NO. 2.—THE PUMPING-STATION.



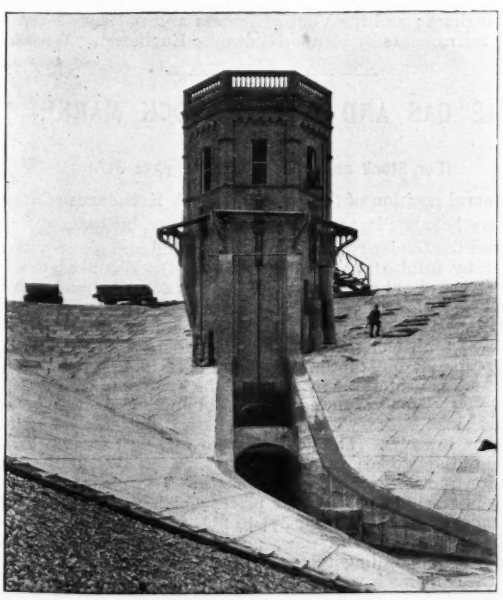
PHOTOGRAPH NO. 3.—THE PUMPING-ENGINES.

PHOTOGRAPH NO. 5.—PUMPING MAINS.



PHOTOGRAPH NO. 4.—FEED PUMPS, FAN, &c.

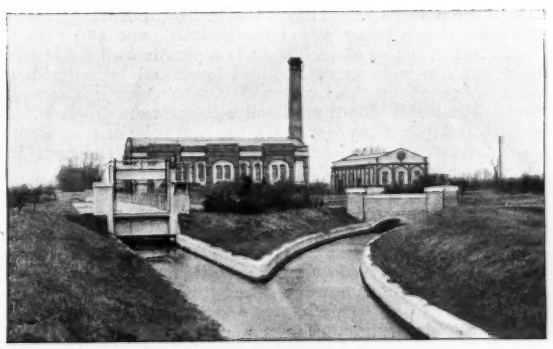
PHOTOGRAPH NO. 6.—BREECHES PIPE.



PHOTOGRAPH NO. 7.—WATER-TOWER.

instruments allow of a complete check being kept on the disposal of the water.

An exceedingly interesting feature of the engine-house, and one which attracted considerable attention on the occasion of the visit, is the arrangement of the piping by which the water is sent into the pumping-mains, shown in Photograph No. 5. It will be seen by the plan that the two outside engines on each side of the group of five deliver through conical pipes (36 in. to 52 in.) into two larger mains, while the centre one can, by means of a breeches pipe (of the shape shown in Photograph No. 6), be made to deliver into either of these mains as may be desired. The larger



PHOTOGRAPH NO. 8.—JUNCTION OF THE AQUEDUCTS AT THE PUMPING-STATION.

PHOTOGRAPH NO. 9.– OUTLET BASIN AND VALVE-HOUSE.

mains, which are of riveted steel, and 6 ft. 4 in. in diameter, run from the house as shown in the plan and in Photograph No. 5. Before reaching the reservoirs, these pipes converge into another riveted steel pipe 7 ft. 10⅛ in. in diameter, by means of the breeches pipe shown in Photograph No. 6, each passing through a 36-inch valve in so doing. This large pipe enters the basement of a valve-house, where it divides into two, of its own size, and again through 36-inch valves; the pipes being tapered so that measurements of the water passing through them may be taken by the Venturi recorders in the valve-house.

THE WATER-TOWERS AND THE RESERVOIRS.

The two 7 ft. 10⅛ inch mains proceed from the valve-house in two tunnels to the bases of the water-towers, one of which is placed in each reservoir (see Photograph No. 7). The stand-pipes for drawing water from the reservoirs are of cast iron 5 feet in diameter, having 48-inch and 36-inch sluice-valves, with bell-mouthed ends fitted to them, to enable the water to be drawn off at any desired level. These valves are worked from a platform at the top of each tower. From the bottom of each stand-pipe a 48-inch pipe conveys the water through the tunnels occupied by the large pumping mains to the valve-house, where it is measured. It is then delivered by the two pipes into a receiving basin about 50 feet in diameter, whence it flows over an aërating weir into an open conduit of the smaller section, which joins the Hampton conduit near the engine-house. The arrangements just described are shown in Photographs Nos. 8 and 9.

The reservoirs have a top-water area of 424 acres, at which level they contain, as already mentioned, 3338 million gallons of water. The embankments (see sections) including the dividing bank, are 4⅝ miles long; and they are composed of the material excavated from the site. They vary in height from 21 feet to 39 feet; the slopes being 3 to 1 on the inside and 2 to 1 on the outside. In the centre of each bank is a puddle wall, 6 feet wide at the top, 7 feet wide at the ground level, and tapering down to 4 feet where it joins the London clay, into which it is securely toothed. The inside slopes are lined with concrete 5 inches thick for a vertical depth of 15 feet below top water-level (see Photograph No. 7), so as to resist the wave action, which is considerable in large sheets of water such as these.

THE DESTINATION OF THE WATER.

As already mentioned, the water will be conveyed by the smaller aqueduct to Hampton, where there is a distributing reservoir having a capacity of 13 million gallons (see map). Before this is reached, however, the stream will be tapped by the New River Company, who are constructing works specially to deal with their portion. These were briefly described in the "JOURNAL" on the occasion of the visit of the Junior Institution of Engineers a short time ago. The water will be led into a rectangular well, in the centre of which is a telescopic vertical pipe, having attached to it a pair of floats, so arranged that the lip of the pipe is always kept at the same distance below the top of the water, irrespective of the level. The same quantity of water must, therefore, always pass through the vertical pipe. The well is contained in a brick building fitted with recording instruments. On the banks of the distributing reservoir are two similar houses—one for the West Middlesex, the other for the Grand Junction Company, who will take the water into their own works, which are close by.

THE CONSTRUCTORS OF THE WORKS.

It only remains to say that the works have been carried out by the firm of which Sir John Aird, Bart., M.P., is the head. They were commenced on April 30, 1898, by the Chairman of the Joint Committee (Mr. Edmund Boulnois, M.P., the Chairman of the West Middlesex Water Company) cutting the first turf; and, though they have not yet passed out of the Contractors' hands, they are practically finished. As already mentioned, the pumping plant was provided by Messrs. James Simpson and Co. The steel pipes were supplied by Messrs. Thomas Piggott and Co., of Birmingham; and the Venturi meters and measuring and recording instruments by Kent's Hydraulic Engineering Works.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 517.)

THE general position of things on the Stock Exchange underwent no material change last week. That is to say, business was very quiet, and the tendency for the most part dull and gloomy, varied at times by fitful attempts at recovery. On Wednesday, when matters were about at their worst, Consols actually touched 89 13/16, a record slump for a long while back. However, prices in general were better at the close. The Money Market was decidedly easy—the supply being more than ample to meet all requirements for short loans; but discount was steady. In the Gas Market, there was a considerable increase in the volume of transactions; but they were to a very great extent confined to dealing in Gaslight and Coke issues, without which, indeed, business would have been at a low ebb. The tendency, so far as indicated by the attitude of the two largest undertakings, was weaker, but changes in London quotations were few and slight. There was some active dealing in Gaslight ordinary at prices which gave way from the commencement, falling from 87¼ to 85½, and closing about mid-way between them. But the secured issues were stronger; the debenture commanding top price, and the preference advancing a point. Not much was done in South Metropolitan; and the price shrank from 124 to 121½ at the close. A few transactions in Commercials were marked at better figures—the 4 per cent. stock changing hands once at a point above the top quotation, in which, however, no change was made. The position and prospects

of the undertaking, as laid before the shareholders at their meeting on Thursday, gave great satisfaction. In the Suburban and Provincial group, there was practically nothing doing in the London Market. In the Provincial Exchanges, Liverpool "B" and Sheffield "C" gained a point, while Liverpool "A" lost one. Newcastle debenture had a smart rise. It should be noted that, while Newcastle ordinary is quoted 98-101 in London, the local quotation is 102½-103½. Business was very quiet in the Continental Companies; and their quotations were unchanged. The same condition applies to the undertakings in the remoter world. The Water Companies are in a highly agitated state. For some time past there has been in operation a progressive shrinkage from the extraordinary figures up to which quotations had been forced; and last week prices received a severe blow, when the answers of the Water Board to the East London and New River claims were published. There is, of course, no reasonable prospect of the Board's contention being upheld; but it sufficed to knock the bottom out of the market on Thursday and Friday, and prices were made quite nominal.

The daily operations were: Moderate dealings in Gaslight issues on Monday; the ordinary falling 1 and the preference rising 1. In Water, West Middlesex fell 5. Tuesday's business was nearly all in Gaslight ordinary, without change. Wednesday was quieter, and prices were weaker. Gaslight ordinary and South Metropolitan relapsed 1 each. East London Water declined 2. There were no further changes in Gas; but in Water on Thursday, Chelsea, East London, Kent, both Lambeths, New River, and Southwark fell 10 each, and Grand Junction, Kent new, and West Middlesex moved down 5 each. On Friday, East London fell 17½, New River and Southwark 15 each, Grand and Junction 11. The Exchange was closed on Saturday.

OBITUARY.

Death has been busy of late in the ranks of the Salford Corporation; and one of the last members of that body to be removed has been a gentleman who had long been associated with the municipal life of the borough, and whose name figured conspicuously in the "JOURNAL" some sixteen years ago, in connection with the well-known Hunter scandal. We refer to Mr. J. G. DE T. MANDLEY. Deceased gentleman, who was in the shipping business, entered the Corporation in 1876 as the representative of Broughton, where he resided; and, having a competent knowledge of finance, he addressed himself with much earnestness to the repair of certain defects of administration, especially in connection with the Gas Department. The result of his activity was the bringing to light of the existence of a condition of things unexampled in the history of the gas industry; and this led to the suspension, by the Mayor, of Mr. Samuel Hunter, the Gas Engineer. At a quarterly meeting of the Corporation on Feb. 9, 1887, Mr. Mandley moved a resolution approving of this action; and Mr. Hunter was eventually dismissed. It is unnecessary to refer to the subsequent incidents in this deplorable business. In the course he took therein, Mr. Mandley was, we are sure, inspired by the highest motives. He displayed more than a perfunctory interest in his work as a councillor, and was unsparing in his denunciation of everything which, in his judgment, was wrong or unworthy. It is no disparagement of him to say that, like Shakespeare's soldier, he was apt to be "sudden and quick in quarrel;" but, unlike him, he was not a seeker after the "bubble reputation." In the words of the Mayor (Alderman Stephens) at the meeting of the Council last Wednesday, "he hit hard, but never unfairly; and no man was freer from the spirit of revenge. He was one who could not be persuaded to flinch a hair's breadth from the course he considered right." Mr. Mandley was appointed a Justice of the Peace in 1893, and three years later was elected an Alderman. He was a man of varied gifts, and took a warm interest in everything calculated to raise the social condition of his fellow-townsmen, as well as in literary and antiquarian matters. He was an excellent Spanish scholar, and, to again quote the Mayor, "a high-souled, warm, and manly man."

Gas Coal Prices.—According to the writer of the City Notes in the "Pall Mall Gazette" of yesterday, "those coal-owners in the North who anticipated a rise in the price of gas coals during the year have not fared very well. The South Metropolitan Gas Company in May and, later, the Gaslight and Coke Company were each able to obtain a concession of about 8d. a ton, which in the latter case meant a saving of about £60,000. The Trieste Gas-Works, which were in the market last week, have secured even better terms than the foregoing; a reduction of about 1s. per ton on last year's figures having been obtained at 8s. to 8s. 6d., the net f.o.b. price. Owing to the comparatively small quantity required—40,000 tons—the fall is more significant than is indicated by the actual amount of the drop. Remembering, also, that the greatest anxiety was evinced on the Newcastle Exchange to secure a part of the Trieste Company's order, there is sufficient proof of very slack times. With the largest purchasers satisfied, prices are receiving but little support; and it looks as though quotations for gas coals must decline still further."

TECHNICAL RECORD.

VARIATIONS IN THE LIGHTING POWER IN THE INCANDESCENT BURNER OF COMBUSTIBLE GASES.

By E. SAINTE-CLAIRE DEVILLE.

[Abstract Translation of a Paper presented to the International Photometric Committee.]

Reference was made in the report of the Special Correspondent of the "JOURNAL" of the proceedings of the International Photometry Committee at Zurich in June* to the valuable and exhaustive communication presented to the Committee by M. E. Sainte-Claire Deville, the Engineer of the Experimental Works of the Paris Gas Company. We are now able to give in the sequel an abstract translation of this *brochure*, of which the title was: "Variations in the Lighting Power in the Incandescent Burner of Combustible Gases, regarded as a Function of their Calorific Power." It opens with an introduction, in which the author describes the aim of his work, the general scheme of his investigations, and the order in which they are reported in the paper. A summary of this introduction has already been given in the "JOURNAL" (*loc. cit.*); but, for the sake of completness, we reproduce it here, and follow it by the several parts of the paper in their original sequence.

The question of the illuminating power developed by incandescent burners mustbe looked at from two entirely different points of view: (1) Given a mantle of definite composition and dimensions, how does its lighting power vary when gases of different compositions are burnt under it? (2) Given a particular unvarying gas, how does the lighting power vary when it is burnt under mantles differing in mode of manufacture or in composition? That is to say, the study of the photometry of incandescent lighting entails a distinction being drawn between the photometry of the gas and the photometry of the mantle.

It is well known that the illuminating power of ordinary gas-flames is not a regular function either of the specific gravity or the calorific power of the gas; and empirical methods, based on certain definite conventions, have been adopted for the determination of this illuminating power, which arises from the carbonaceous particles suspended in the flame. But the conditions are totally altered when the incandescent mantle is employed. Every gas which yields heat on its combustion, can likewise yield light. Further, it seems fair to assume that for a given quantity of heat expended in a given time under a particular mantle, the same quantity of light will be obtained whatever may be the composition of the gas used. Thus the value of different gases per unit volume would vary inversely with the volume required to yield a given amount of heat; in other words, it would be proportional to the heat of combustion of a cubic foot of the gas. But there is one serious objection to this theory—viz., that the brilliancy of a mantle depends primarily upon the temperature of the flame by which it is heated. Some gases yield a hotter flame than others, even when the heat expended remains the same. The question is, Does this peculiarity play an important part in practice, and is it a question which only experience can answer? The author has worked at intervals, since the beginning of 1898, with the object of solving it. His studies have led him to the conclusion that the theoretical temperature obtainable by the combustion of a gas is a negligible factor in all ordinary cases, and that consequently the heat of combustion remains the principal and essential criterion of the value of any gas so far as its use for incandescent lighting is concerned. The author, therefore, thinks there is no occasion to agree upon international rules for the photometry of gas employed in incandescent lighting. On the other hand, the photometry of mantles will only be practically serviceable in the future when it is carried out according to uniform rules, which will ensure results comparable with one another being obtained in different countries.

The paper embodies three sections, of which the first reproduces, with small verbal changes, an unpublished account, from records of the experimental gas-works at Paris, dated March 25, 1901, of a "Study on the Intensive Combustion in the Welsbach Burner of Coal Gas of Widely Different Qualities." The second is similarly a reproduction of an unpublished record on "The Measurement of the Illuminating Power of Gas in Incandescent Lighting, and a Definition of a Rational Mode of Photometry therefor" (dated June 22, 1901). The third section presents a summary—specially prepared for the meeting of the Committee—of (*a*) some observations made in and after the second week of 1901 to supplement those quoted in the second memoir; (*b*) the two memoirs which constitute the first and second sections; and (*c*) a dissertation on the same questions, dated Dec. 18, 1894, and of too great length for reproduction in its entirety. Finally, the whole matter is discussed; and the conclusions as to the determination of the illuminating power of the gas in incandescent lighting, and that of the mantles, are stated.

* See "JOURNAL," Vol. LXXXII., p. 886.

[Note by Translator.—It has been impossible to give equivalents of the photometrical measurements recorded in this communication in terms of English standards and measures, for reasons which will be apparent from the following statement of the relations between the methods of photometry in common use in France and England: The standard of light in France is the carcel lamp, the intensity of which is, on an average, equivalent to the light of 9·5 English sperm candles.* The gas to be tested is in France burnt in the bengel gas-burner at the rate required to yield a light exactly equal in intensity to one carcel, and the illuminative value of the gas ascertained in this way is expressed by stating this rate of burning in litres per hour. There are 28·3 litres in a cubic foot. There is no fixed ratio between the light afforded by the bengel burner and that given by the "London" argand when the same gas is burnt in them at the same rate of consumption. The ratio varies with both the quality of the gas and the rate of consumption, and has not been established for different conditions.† In England, the gas to be tested is consumed in the "London" argand burner, with a chimney of suitable size, either at the fixed rate of 5 cubic feet per hour, or at the rate required to yield a light of 16-candle power. Apart from the different illuminating duty afforded by the bengel and "London" argand burners, comparisons between results obtained by the French and English methods of photometry cannot be fairly made, because, on the one hand, the rate of consumption required to yield a light of one carcel in the bengel burner is rarely so high as 5 cubic feet (141·6 litres), while, on the other, there is no established relation between the rates of consumption required to yield a light of 16-candle power in the "London" argand burner, and a light of 9·5-candle (1 carcel) power in the bengel burner. Consequently, translation of the photometrical measurements here recorded into English terms is out of the question; and the measurements must be considered only as comparable between themselves. With regard to the results of testings of calorific power, they are stated in "calories per cubic metre" (or occasionally, in "calories per litre"). One calorie per cubic metre is equal to nearly 0·1124 British thermal unit per cubic foot.]

I.—On the Combustion of Coal Gas of Widely Different Degrees of Richness in the Welsbach Burner.

If an ordinary No. 1 Welsbach burner, of which the apertures for the entering of gas and air have been adjusted by the maker to suit the average gas of Paris, is taken, and supplied successively with samples of coal gas gradually increasing in richness, and having the following characteristics,‡ the results shown below are obtained:—

No.	Lighting Power (Bengel.)	Density.	Heat of Combustion. (Calorimetric Bomb.)	
			Gross (Water Condensed).	Net (Water as Steam).
	Litres.		Calories.	Calories.
1	156·26	0·2986	4606	4181
2	117·85	0·3751	5498	5007
3	104·65	0·3887	5755	5250
4	97·78	0·4239	6220	5691
5	80·29	0·4987	7062	6489

If, during the photometric test, the consumption of gas is regulated by the cock of the meter so as to produce the maximum of light, the normal consumption, such as a careful consumer would be likely to incur, is arrived at. Working under these conditions, it is found that as we pass from No. 1 to No. 5, the consumption of gas continues to diminish (from 95·8 to 50·5 litres). The heat evolved per hour—*i.e.*, the net heat of combustion of the volume of gas—likewise decreases from 400·7 to 327·5 calories. As regards absolute luminous intensity, it falls to 3·07 carcels for the richest gas from its maximum of 4·09 carcels for the poorest gas. The useful lighting effect for equal volumes of gas increases as follows:—

	Poor Gas.		Rich Gas.
Intensity per 100 litres of gas .	4·27 carcels	..	6·07 carcels.

Or inversely—

Consumption per carcel . . .	23·4 litres	..	16·5 litres.

Lastly, the useful lighting effect per unit of heat evolved—*i.e.*, the intensity of light per 1000 calories net—ranges from 10·2 carcels for the poor gas to 9·3 carcels for the rich gas.

These figures must not lead to the supposition that the poor gases are more advantageous than the rich ones for incandescent lighting; for both rich and poor were tested in one and the same burner. If each gas is consumed in the burner best suited to it, or if, more simply, a burner is provided in which the quantities of air and gas can be adjusted to each other, it will be found that for quantities corresponding to a consumption of 300 to 400 calories per hour the maximum luminous intensity remains proportional to the heat produced. The quantity of air they require can by these means be supplied to rich gases at the base of the bunsen; and under these conditions they give, per 1000 calories, the same results as poor gases. In other words, for the same volume used, the illuminating effect is proportional to the heat liberated by the gas consumed. Thus, in the ordinary use of the Welsbach burner, the luminous return for the heat produced may seem greater for poor gases; but this is due to the fact that at the usual pressure the burner does not treat the rich gases properly, supplying them with insufficient air.

To sum up, the experiments made in 1894 enable one to conclude that, in principle, the different gases produce the same quantity of light for the same production of heat in the Welsbach burner; in other words, the luminous effect obtained in proportion to the volume burnt is proportional to the heat of combustion of the gas, assuming always that each gas is burnt with the proportion of air at the base of the bunsen which best suits it. It must be added that these generalizations have been established experimentally only for small burners, in which the consumption of heat does not exceed 350 to 450 calories. The author considers it probable that experiments made in Germany, and alleged to indicate that coal gas enriched with benzol is less favourable in the Welsbach burner than the same gas unenriched, are nothing more than a repetition of the first of the two series of experiments just mentioned. Had air been artificially supplied, as was done in the second of the series, to the enriched gas, it would have been found that its lighting power in a Welsbach burner is superior to that of the unenriched gas for equal volumes, and for the same quantity of heat produced.

With regard to the influence of temperature on the combustion of gas, at the time Herr Oechelhaeuser's Inaugural Address at the Cassel meeting of the German Association of Gas and Water Engineers* drew attention to this point, Dr. Strache, of Vienna, announced that water gas, burnt pure in his patented burner, supplied a quantity of light almost as great, for equal volume, as did coal gas, and therefore double for equal production of heat. These facts suggested to certain minds the idea of a plausible theory couched somewhat in the following terms: Water gas and its components, hydrogen and carbonic oxide, possess a temperature of combustion distinctly higher than that of coal gas. Now, as the brilliancy of Welsbach mantles depends essentially—other things being equal—on their temperature, it is not the heat of combustion of the gas which is the chief factor in the brilliancy of the mantle, but the temperature of combustion. Hence there is no need for surprise that water gas gives a better result than coal gas. One can even assume also that the poor coal gases, which are rich in hydrogen, have a higher temperature of combustion, and therefore are more efficient for incandescent purposes than rich gases. [It will be seen farther on that this hypothesis is incorrect, although at first sight it seems plausible enough.] This hypothesis has something seductive about it. But it must be remembered that, in practice, *the temperature of the mantle remains much below the theoretical temperature of the flame.* In reality, were the mantle to reach the theoretical temperature in the case, for example, of an ordinary No. 1 Welsbach burner producing 450 to 500 calories per hour, it would be impossible to obtain, with the same gas, a greater luminous intensity, since no increase could be made in the temperature of the mantle.

Now, experience proves that this same No. 1 burner, giving 4 carcels for an hourly consumption of 400 calories, can be raised to an intensity of 28 carcels—*i.e.*, seven times as great—by pushing the supply of air and gas to its extreme limits; that is to say, by effectively increasing the consumption to from 1500 to 1600 calories per hour.

Thus, if it is wished to emphasize the true influence of the theoretical temperature of combustion of the flames of different gases, it is necessary to work under the most intense conditions. The course of experiments suggested in this direction is evidently as follows: Take the complete series of gases—hydrogen, carbonic oxide, water gas, coal gas, very poor, poor, average, and rich. Measure or calculate for each gas, as is best suited in each case, the following constants: Heat of combustion, density, ordinary lighting power, composition, and theoretical temperature of combustion. Then produce, with each gas and under the same mantle, flames rising in intensity—a burner fed by artificial air being used. For example, given a gas of 5000 calories per cubic metre, the consumption of gas will be fixed successively at—

About	100	litres	(say)	500	calories	per	hour	(*a*)
,,	150	,,	,,	750	,,	,,	,,	(*b*)
.	.	.	.	.	.	.	.	.
,,	400	,,	,,	2000	,,	,,	,,	(*n*)

For each case *a b* . . . *n*, the consumption of air will be regulated in such a manner that it is impossible afterwards to alter it one way or another without reducing the luminous intensity. This done, the photometric test is made, and the output of gas and heat noted, as well as the quantity of air supplied to the bunsen, and the luminous intensity of the mantle. This latter will increase on passing from *a* to *b*, from *b* to *c*, and so on; but a point will be reached at which it attains an upper limit beyond which it cannot pass. It seems reasonable to assume that this

* See "Journal," Vol. LXXXII., p. 957. † *Ibid.*, p. 445.

‡ Each gas was a product of the distillation of coal. The poorest were drawn off towards the end of working off a charge; the richest at the commencement. Each line in the table represents the mean of seven or eight samples of gas, all of practically the same degree of richness.

* See "Journal," Vol. LXXIV., p. 764.

instant coincides with that when the mantle reaches equilibrium, as regards temperature, with the flame.

Now, it is impossible to carry out such a series of experiments in an ordinary burner, as the composition of the gas, whether rich or poor, modifies the conditions under which an explosive mixture is formed at the base of the burner. With very poor gases (below 3000 calories per cubic metre), lighting-back at the base takes place before the maximum intensity of the flame is reached. For such reasons as these, no doubt, Dr. Strache has used an actual argand burner for pure water gas; the air and gas meeting in the cavity of the mantle. But such an arrangement cannot ensure a sufficiently intimate mixture of the air and gas. This fact is mentioned to explain why the experiments detailed below do not include water gas and very poor coal gas. The trials must be restricted to coal gas rich enough to be efficiently used in a No. 1 Welsbach burner.

The five series of experiments were all made with different mantles. Each series included two sets of photometric tests. The first consisted of a simultaneous and comparative trial (other conditions remaining the same) of a poor gas and a rich gas. The two experimental gasholders were filled, one with rich gas taken at the commencement of working off a charge of coal, and the other with poor gas taken at the end of the working from the same retort. With these two gases, the two series *a b . . . n*, as above, were undertaken, first with the rich gas and immediately afterwards with the poor gas. The second test consisted of a trial of the average gas throughout a make. The following day the same series of operations were repeated with the same mantle, and the average gas produced from the same coal.

Five complete series were made, each with a different mantle and coal. The results were then condensed into a single series of figures by the aid of graphic methods and averages—the five poor, the five medium, and the five rich gases being taken in three separate groups. The results of only the poor and rich gases are given below. The constants of the two gases were—

	Mean of Five Poor Gases. Litres.		Mean of Five Rich Gases. Litres.
Consumption per bengel-carcel (10° C. and 760 mm.)	288·8000	..	76·6200
Density of the dry gas (0° and 760 mm.)	0·3161	..	0·5344
The composition of the gases was—			
Benzene vapour	0·770	..	1·346
Propylene	0·000	..	2·912
Ethylene	0·624	..	3·782
Methane	23·878	..	44·066
Hydrogen	64·642	..	36·560
Carbonic oxide	7·252	..	7·280
Carbonic acid	1·434	..	2·654
Nitrogen	1·000	..	1·000
Oxygen	0·400	..	0·400
	100 00	..	100·00

The heat of combustion per cubic metre of gas (constant pressure) was—

	Calories.		Calories.
(1) Observed by a Junkers calorimeter per cubic metre at 10° C. and 760 mm.—			
Water condensed	4475	..	6912
,, as steam	4072	..	6346
(2) Per cubic metre of dry gas, at 0° and 760 mm. (water as steam)—			
Observed	4302 (100·0)	..	6719 (100·0)
Calculated from analysis	4354 (101·2)	..	6670 (99·2)
	Litres.		Litres.
Volume of gas (10° C. and 760 mm.) producing 100 calories on combustion (water as steam)	24·56	..	15·76
Volume of air required for complete combustion of 100 litres of gas	439·30	..	695·30
Volume of total products of combustion of 100 litres of gas	503·10	..	775·00
	Per Cent.		Per Cent.
Composition of products of complete combustion—			
Nitrogen	69·34	..	71·17
Water vapour	23·03	..	18·72
Carbon dioxide	7·63	..	10·11
	100·00		100·00
Theoretical temperature of complete combustion, calculated by Le Chatelier's method	1949° C.	..	1950° C.

Passing now to the table below, the luminous intensities given therein correspond to amounts or consumptions of heat rising from 500 to 1600 calories. In regard to these figures, it should be noticed that with the poor coal gas a higher absolute intensity can be reached than with the rich gases. While an ordinary Welsbach No. 1 burner has been able to produce up to 30·77 carcels with a poor gas, more than 24 carcels cannot be obtained with a rich gas. The mean of the maxima for the five mantles was 27·5 carcels for the five poor gases, and 20·44 carcels for the five rich gases. The mantles used had an apparent area (area of the vertical projection of the luminous part of the mantle) of about 12 square centimetres; and the mean brilliancy was 2·3 carcels per square centimetre for the poor gases, and 1·7 carcels for the rich gases. These observations prove that the combustion of the poor gas can raise the mantle to a higher temperature than the combustion of the rich gas, and that, whatever may be the theoretical temperature of the flames of the poor gases, it is not higher than that of the rich gases. The two figures already given are 1949° and 1950° C. This item must be borne in mind in the sequel.

TABLE I.

	Consumption per Hour.		Luminous Intensity in Carcels.			Volume of Air per 100 Litres of Gas.*	Gas Consumed per Carcel, in Litres.
	Gramme-Calories.	Litres of Gas.	Absolute.	Per 1000 Calories per Hour.	Per 1000 Litres of Gas.		
Poor Gases.	500	122·8	6·42	12·85	5·228	340	19·13
	600	147·4	9·06	15·10	6·146	356	16·27
	700	171·9	11·62	16·60	6·760	370	14·79
	1000	245·6	18·62	18·62	7·581	382	13·19
	1300	319·3	23·79	18·30	7·451	383	13·42
	1500	368·4	26·37	17·58	7·158	383	13·97
	1600	393·0	27·52	17·20	7·003	383	14·28
Rich Gases.	500	78·8	6·70	13·40	8·504	530	11·76
	600	94·5	9·10	15·17	9·627	570	10·37
	700	110·3	11·48	16·40	10·420	595	9·76
	1000	157·6	17·20	17·20	10·915	618	9·16
	1300	204·9	20·21	15·55	9·868	617	10·13
	1500	236·4	20·25	13·50	8·567	616	11·67
	1600	252·1	19·68	12·30	7·806	615	12·81

* Volume of air mixed with the gas at the base of the bunsen burner in order to obtain the maximum intensity from the gas.

(To be continued.)

GAS SUPPLY IN SWITZERLAND.

The reports which have appeared in the "JOURNAL" of the proceedings at the meeting of the German Association of Gas and Water Engineers at Zurich on June 24–26 referred to the fact that the Swiss Association of Gas and Water Engineers held their annual meeting for this year in conjunction with that of the German Association. Actually, however, it had one separate sitting, on the 24th of June, at three p.m., at which the President, Herr Rotenbach, the Manager of the Berne Gas-Works, took the chair.

The annual report of the Association, which was presented, showed that there were 164 members. The election of officers for the ensuing year resulted in Herr Miescher, the Manager of the Bâle Gas-Works, being selected as President; and Herr Weiss, the Manager of the Zurich Gas-Works, as Secretary. Lausanne was chosen as the place for next year's meeting of the Association.

Several questions were briefly discussed—such as the rates of carriage of coke and accident insurance.

The Association had prepared a valuable *brochure* giving particulars of the gas, water, and electricity supply works of Swiss towns, together with information as to their principal industries, position, &c. From it we extract the following particulars with regard to the larger gas undertakings in Switzerland:—

Town.	Population. (about)	Make of Gas in 1902. Cubic Feet. (about)	Cubic Feet of Gas Consumed per head, exclusive of Public Lighting.	Price per 1000 Cubic Feet of Gas for Lighting Purposes.
Bâle	114,000	447,500,000	3,600	4s. 6d.
Berne	70,000	177,700,000	2,260	5 7
Bienne	24,000	52,200,000	1,794	5 7
La Chaux-de-Fonds	37,000	87,600,000	2,365	5 7
Geneva	106,000	300,600,000	2,895	4 11
Lausanne	45,000	133,500,000	2,475	5 7
Lucerne	31,000	75,000,000	2,010	5 7
Neuchâtel	22,000	35,700,000	1,412	4 10
St. Gall	33,500	143,500,000	2,966	—
Schafthausen	20,000	32,800,000	1,270	5 7
Vevey	12,000	69,200,000	1,895	4 6
Winterthur	23,000	132,500,000	4,345	5 7
Zurich	155,000	568,000,000	3,108	5 7
Plainpalais	—	67,900,000	—	—

There are, further, over 30 smaller gas-works in Switzerland. In many cases substantial discounts are allowed on the prices given above; and a lower price is commonly charged for gas supplied solely for heating, cooking, or industrial purposes. Some of the gas-works—*e.g.*, Winterthur—supply outlying districts, of which the population is not stated, and the consumption per head then refers to the urban district only.

By the death of Mr. Noel Whiting, of Lavender Hill, Battersea, the Directors of the Southwark and Vauxhall Water Company have lost an esteemed colleague, and charitable institutions will benefit to the extent of about £40,000. The deceased gentleman left estate of the estimated value of £649,629; and among the bequests under his will are £10,000 to the Ironmongers' Company, £5000 to the poor of Battersea, a similar sum to the Bolingbroke Hospital, £3000 each to the London, Guy's, and St. George's Hospitals, and £2000 each to the University, Dental, and Vernon Hospitals.

VERTICAL GAS-RETORTS IN AMERICA.

A Combination Coal and Carburetted Water-Gas Process.

In the "JOURNAL" for July 14, p. 104—consequent on a communication received from Mr. Frederic Egner, and published in the same issue, p. 110—some particulars were given of an arrangement of vertical retorts patented in America as far back as 1880 by Mr. C. F. Dieterich, of Baltimore, and which (in what appeared to be in some respects essential features) bore a striking resemblance to some of the present-day arrangements of vertical retorts that have roused so much interest of late in gas circles. In response to a letter addressed to Mr. Dieterich—asking for some indication of why it was, from the patentee's point of view, the arrangement failed to get adopted—he sends copies of four subsequent patents, taken out last year between February and August, and which he looks upon as an improvement on his own patent of twenty-three years ago. Though standing in the name of Mr. Charles W. Isbell, of New York, Mr. Dieterich says that he controls all these patents.

On the general subject, our correspondent writes: "Regarding the vertical retort setting proper, the patents for which were issued in 1880, I was at the time so favourably impressed with the value of this invention, that I built a setting of six large retorts. Further I did not go; for the reason that then the demand for higher illuminating power than could be furnished with coal gas became so strong in the larger cities of America, that gas companies turned to water gas almost entirely—I, also, laying aside for the time being my vertical retorts. Lately, however, the high prices of gas oils are bringing about a change of mind; gas companies are turning back to coal gas. I am afraid of it; because I fear that consumers, after having for years used 25 to 30 candle gas, will not be content any more with coal gas, and if forced to will turn to electricity. This reasoning has led to the change of my old vertical retort-setting into an apparatus by which a mixture of coal and water gas may be produced—enabling the operator to change the percentage of these gases in the mixture at will, and in accordance to the demand for a lower or a higher candle power product. Of course, when the latter is necessary, more oil for enriching the water gas part would have to be used. Although these supposed improvements have not yet been practically tried, I look for favourable results."

We may now proceed to give some particulars of the inventions referred to, and such of the illustrations accompanying the specifications of the patents as appear necessary to indicate the character of the plant needful to carry out Mr. Dieterich's present-day ideas.

CHARLES W. ISBELL'S PATENT NO. 693,137, FEB. 11, 1902.

This relates to apparatus for the manufacture of illuminating gas from bituminous coal in vertical retorts. The improvement relates in part to "the construction of the retorts themselves, whereby provision is made for the expansion of the coal therein, for the free escape of the gas from the coal, for the loosening of the residual coke, and for preventing the impoverishment of the gas by the carbonization and deposit in the coke of any of its illuminating elements." The improvement further relates to appliances used in connection with upright coal-gas retorts, for the enrichment or improvement of the illuminating quality of the coal-gas by the distillation within the retorts themselves, and in the outlets therefrom, of suitable liquid hydrocarbons.

Fig. 1 represents a plan of the apparatus; and fig. 2, a vertica section on the line 2 2 of fig. 1. Fig. 3 is a transverse vertical section on the line 3 3 of figs. 1 and 2; and fig. 4, a horizontal section on the line 4 4 of fig. 2. Fig. 5 is a transverse vertical section of the head of one of the retorts and of the dry main (on a larger scale); and figs. 6 and 7, vertical sections at right angles to each other of the lower part and bottom of one of the retorts.

The upright retorts may be of any horizontal section and of uniform size from top to bottom. They are provided with fixed iron heads or mouthpieces and with iron bottoms hinged to the floor-plate to provide for the discharge of the residual coke. The slides of the retorts are grooved vertically from top to bottom, as shown in figs. 2, 3, 4, 6, and 7. The mouthpieces, through which the retorts are charged, are all fitted with sliding lids. The two rearmost retorts of each row—viz., those farthest from the furnace—are not intended to be charged with coal, but are to serve as chambers for fixing the gas generated in the other retorts. For this purpose each is provided with a transversely-arranged hanging partition or curtain (shown in fig. 2), which reaches from the top of the head to within a short distance of the bottom of the retort itself.

For each row of retorts there is provided a dry main M, consisting of a box or tube arranged horizontally at one side of the row of retort-heads, and extending the whole length of the row. The dry mains are embedded in the upper part of the masonry of the heating-chamber (to be heated by the heat of the chamber), and each is connected, by short pipes N, with all the retort-heads of the adjacent row. The connections with the heads of the rearmost retorts or fixing-chambers are made in front of their partitions O; and these last-mentioned heads are connected in the rear of the partitions by pipes P with the ordinary hydraulic main W, so that the gas from all the retorts and the dry main is caused to pass first downward and then upward through the rear retorts, "wherein its fixation is effected or assisted by the great heat to which the latter retorts are subjected." The several pipes within the dry main are furnished with valves, the stems of which pass through stuffing-boxes provided in the outer walls of the dry main and operated by levers, working in small pits formed in the masonry outside the mains, so as to quite shut off any one or more of the retorts from this dry main.

The hinged lids or bottoms (seen in figs. 2 and 3, but better

Fig. 1.

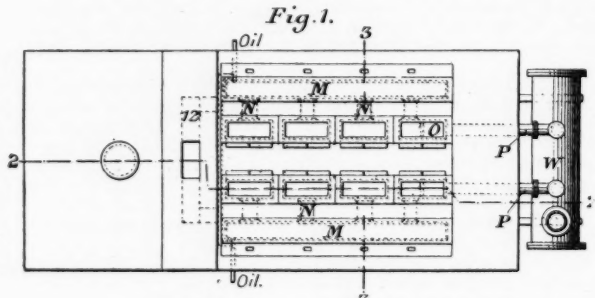


Fig. 2.

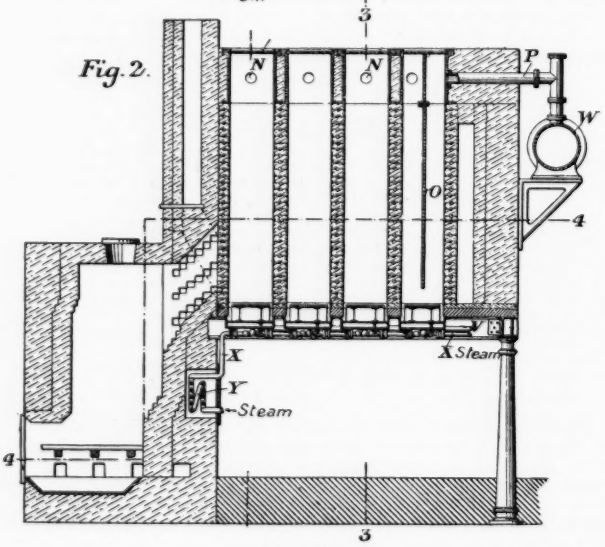


Fig. 3.

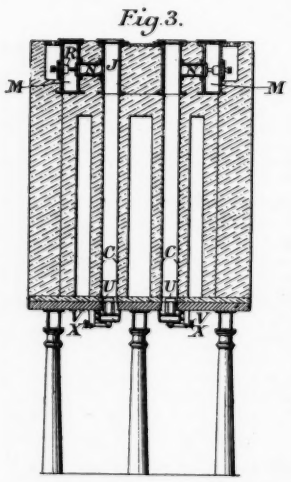


Fig. 4.

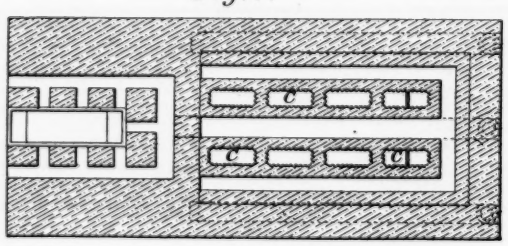


Fig. 5.

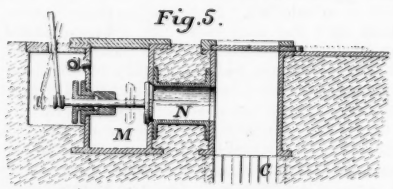


Fig. 6.

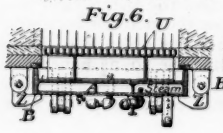
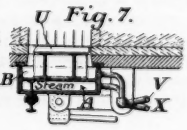


Fig. 7.



in figs. 6 and 7) consist each of a slab made hollow to form a tight chamber A, for the reception of air or steam to be supplied therefrom to the interior of the retort, for a purpose to be hereafter explained, through a valve, which may be opened and closed by the attendant. The stem of the valve passes through the chamber A and through a stuffing-box in the bottom, outside of which it is furnished with any suitable hand-gear. Above the chamber, the sides of the slab project upward to form a pan B, for the reception and temporary retention of any tar which may be distilled from and settle down through the coal in the retort, and from which naphtha and benzol or other hydrocarbons may be distilled for the purpose of enriching the coal gas. The pan serves also to receive liquid hydrocarbons from any outside reservoir or source for the same purpose of enrichment. The edges of the pan are made to form tight joints with the floor-plate, by asbestos packing inserted in grooves in the bottom of the plate. On the bottom of the pan there is carried by supports a grate U, which forms the interior face of the retort bottom, and upon which the coal in the retort is supported. The retort bottom, thus constructed and hinged to the floor-plate, is held in place (until the time for discharging the coke) by means of swinging hooks *Z*, as shown in fig. 6.

To provide for the introduction into the several pans B of the retort bottoms of liquid hydrocarbon from any suitable reservoir or outside source, a fixed pipe V runs under the floor-plate along the whole length of each row of retorts; and from this pipe there are branches leading into the several pans. The branches have some sort of flexible connection with the pipe V, in order to permit the opening and closing movements of the retort bottoms on their hinges. To provide for the introduction of steam or air (preferably superheated steam) into the chamber A, a fixed pipe X runs under the floor-plate along the whole length of each row of retorts; and from this pipe branches run one to each chamber. These branches are composed of two pipe-sections and a spigot-joint connection, which are like the spigot-jointed branches from the pipe V before described. The pipe X is represented in fig. 2 as receiving steam through a superheating coil Y, which is arranged in a small heating-chamber in the masonry of the rear-wall of the furnace, to be heated by the heat of the furnace. Steam or air admitted from the chamber to the retort, by opening the right valve A after all the gas has been distilled from the coal in the retort and only coke is left, will find it way upward between the coke and the sides of the retort and through the channels, and so produce combustion of the portions of the coke close to the sides and in the channels, and the conversion of these portions into gas, thereby so loosening the charge that it will drop easily from the retort when the bottom is opened.

Isbell's Patent No. 699,870; May 13, 1902.

This originally formed part of the application for patent No. 693,137, but was subsequently ordered to be separated from it.

The object sought to be attained be the inventor is "to provide for the so loosening of the residual coke from vertical retorts that it may be permitted to drop, or be pushed, out easily downwards when the retort bottom is opened for its discharge."

To effect this, the retorts are constructed with upwardly running channels in their sides, and means for the introduction into the lower parts of the retorts of air or steam, which, finding its way upward through the channels, "produces the combustion and gasification of such small portions of the coke as may remain in parts of the channels, and as may occupy the parts of the retort directly adjacent to the channels, and so loosen the remainder occupying the body of the retort."

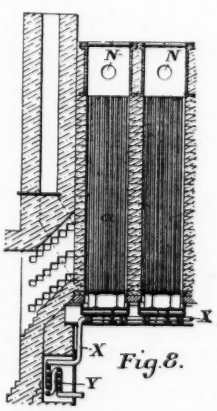


Fig. 8.

Fig. 9.

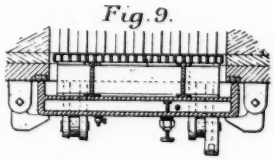


Fig. 10.

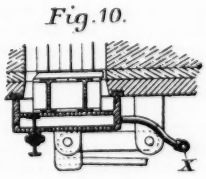


Fig. 8 represents a vertical section of the apparatus. Figs. 9 and 10 are vertical sections at right angles to each other of the lower part of a retort and the means for supplying air or steam thereto. The upright retorts have their interior surfaces grooved to form channels running directly from bottom to top. The retorts may be of any horizontal section, and, so far as their exteriors are considered, may be of any suitable construction, and set in any suitable manner. But as represented, they are built of fire-brick in two parellel rows into the same structure, with their heating-chamber of masonry. To provide for the introduction of steam or air (preferably superheated steam) a fixed pipe X runs under the floor-plate; and from this pipe flexible branch-pipes run one to the chamber of each lid. The pipe X is represented in fig. 8 as receiving steam through a superheating-coil Y, which is arranged in a small heating-chamber in the rear-wall of the furnace, to be heated by the heat of the furnace.

The channels in the retorts are of such width and depth that, when the retort is charged (according to the patentee) with the coal ordinarily used for manufacturing coal-gas, the coal will not fill the channels; but even when it expands—as it does in the process—it will leave the channels partly unobstructed, so that the gas generated and liberated by the heat from the coal in the body of the retort, finding its way into the channels, will have a ready upward passage through them to the outlets N provided in the retort head. The channels—besides thus forming passages for the upward exit of the gas—constitute spaces into which the coal can expand as it is gradually coked; and, moreover, when air or steam is introduced into the retorts and the bottom chambers, after the coal has been completely coked, the air—entering through the grate U, and passing upward through the channels—produces such combustion of the coke in the channels and in the contiguous parts of the retort close to the sides of it, as to quickly so loosen the residue that, on the opening of the lids, it may fall out by gravitation, or be easily expelled by pushing it down from the top.

Isbell's Patent No. 706,238; Aug. 5, 1902.

The patentee illustrates this further suggestion in the construction of a vertical retort-bench by giving: Fig. 11, a vertical and horizontal section of the apparatus; fig. 12, a plan of one of the sections of which the retorts are built up; and fig. 13, a side elevation corresponding with fig. 12.

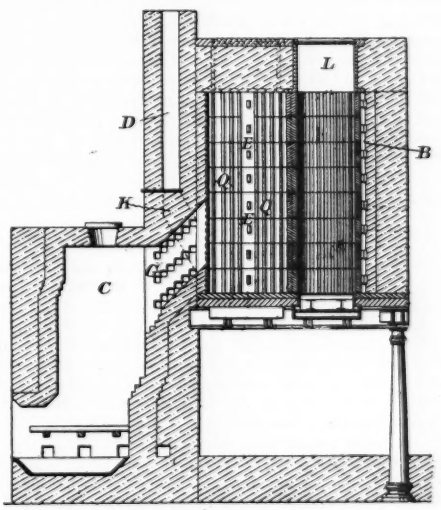


Fig. 11.

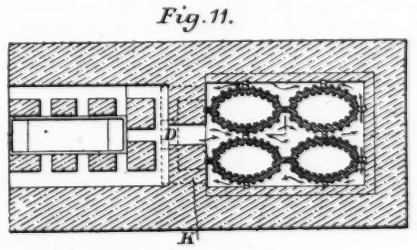


Fig. 12.

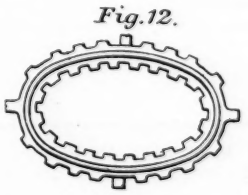
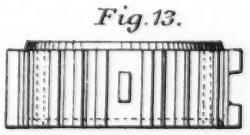


Fig. 13.



The upright retorts are represented as arranged in two parallel rows within a heating chamber B, of masonry, through which, between and around the retorts, the products of combustion from the furnace C circulate to the chimney D. The chambers and the retorts are erected upon a floor-plate faced with fire-brick, and supported on beams, which are themselves supported in part by columns and in part by a structure of masonry, which includes the furnace C.

The retorts, which have single walls, may be of any suitable form in horizontal section, though preferably elliptical, as shown in fig. 11. They are represented as built up to a suitable height of a number of sections of fire-clay, of convenient depth, each

forming a complete portion of the height of the retort; the several sections being matched together by a tongue running around one and entering a corresponding groove in the next one—the matched joints thus formed being packed with asbestos or other suitable packing. The retorts have in their inner faces numerous upright grooves, which form spaces into which the bituminous coal may expand, as it does in its conversion into coke, and which also serve as channels for the free upward exit of the gas generated in the retort. The retorts have on their exteriors upright solid ribs, which constitute reinforcements to compensate for the weakening that would otherwise result from the grooving or channelling of the interior, and also present increased heating-surfaces to the gases from the furnace which surround them within the heating-chamber. Besides the outer ribs, the retorts have also on their exteriors more prominent ribs or projections—to abut against the side and end walls of the heating-chamber B, and on the adjacent faces of the retorts of the two rows abutting together. In this way, the ribs constitute means for the mutual bracing of the several retorts, and the bracing of them against the walls of the heating-chamber in such manner as to counteract any tendency to deformation of the retorts by the heat to which they are subject, or by the expansion of the coal within them.

In order to provide for the circulation of the gases within and through the chamber B, between and around the retorts from the furnace C to the chimney D, the ribs on the fronts of the front retorts, and those on the adjacent retorts of each row, are made continuous from top to bottom of the retort; but the ribs on the backs of the rear retorts are interrupted at intervals, and so are the ribs on those sides of all the retorts which are next the side walls of the chamber B and the ribs between the retorts of the two rows. These interruptions, which form passages between the retorts themselves, and between them and the walls of the chamber B, may be formed by making the ribs extend only part of the way up the retort-section, as illustrated by the ribs in fig. 13, or else by making an interruption in the middle of the rib, as shown in the same figure. With this construction of retorts, and their setting in the heating-chamber, the hot gaseous products of combustion from the furnace C, entering the chamber B by the central flue, pass between the two rows of retorts, thence outward in opposite directions around the backs of the retorts of each row, thence forward between the two rows of retorts and the side walls of the chamber, and thence through the side flues K (shown in dotted line in fig. 11) to the chimney D.

ISBELL'S PATENT No. 707,783; AUG. 26, 1902.

With the specification of this invention, the patentee filed drawings identical with those attached to Patent No. 699,870—see figs. 8, 9, and 10 above—stating that the object aimed at here is "to facilitate the discharge from the retorts employed in the manufacture of illuminating gas from bituminous coal of the residual coke resulting from such manufacture." It is well known, he remarks, that in such manufacture the coal in changing to coke expands, and tends to so tighten itself against the sides of the retort as to require the exertion of considerable force for its removal. For the purpose of loosening the coke from the retort after all (or as much as is desirable) of gas suitable for illumination has been obtained from it, the proposal is to introduce into the retort—especially along the sides—steam, preferably superheated, for the purpose of producing the decomposition or combustion and conversion into gas of portions of the coke close to the sides of the retort, and thereby loosen the greater portion of it. The invention is said to be applicable with especial advantage to upright gas-retorts, in which the expansion of the charge is productive of greater difficulty of discharge, but from which, when the charge is loosened, as mentioned, the coke may drop out by gravitation on the opening of the retort at the bottom.

After detailing the construction and working of this arrangement in words almost identical with those employed in the specification of the earlier patent, Mr. Isbell concludes by claiming as his invention under the present application: "In the process of manufacturing illuminating gas from bituminous coal, the loosening of the residual incandescent coke remaining in the generating retort after the expulsion of the gas to the extent desired, by the introduction into the retort, around the coke, of a sufficient quantity of steam to produce the decomposition or combustion and conversion into gas of the portion of the coke contiguous to the sides of the retort."

The Purifiers at the Evesham Gas-Works.—In connection with Mr. Milbourne's article, "Extensions at the Evesham Gas-Works," in last week's issue, p. 427, it may be mentioned that the old purifiers at Evesham were taken out, and two of them substantially repaired and re-erected in a new position to serve as lime boxes to the new set of oxide purifiers. The old foundations were altered, and made ready to receive the new patent purifiers, and the whole six were erected complete, tested, and started to work, by Mr. Fletcher, with his own staff of gas-works men, in the remarkably short space of time of four weeks—an achievement which certainly reflects a great deal of credit upon the Engineer and his staff. The contractors for the purifiers were Messrs. C. & W. Walker, Limited, of Donnington, Shropshire (who are sole makers of the Milbourne patent purifiers), and they delivered them complete within eight weeks.

LOSS OF ILLUMINATING POWER OF MANTLES WHILE BURNING.

By A. H. WHITE and M. E. MUELLER.

[A Paper read at the Meeting of the Michigan Gas Association, Feb. 18-19, 1903.*]

The papers which have been read at your previous meetings, giving results of investigations carried on in the Chemical Laboratory of the University of Michigan,† have dealt with conditions under which the incandescent gas-mantle gives its best results, and the effect of temperature on illumination. For this year, we have chosen to study the causes of the deterioration of mantles while burning. We have not considered the effects of shock or vibration of any sort, which by mechanical action breaks the mantle, but have endeavoured to find some reason for the slow drop in illumination and efficiency which takes place during its life. Some change must occur, either in its micro-structure or chemical composition; and it has been the nature of this change that we have been studying.

The deterioration of the mantle has been commonly believed to be progressive and regular; but photometric tests have almost universally revealed marked fluctuations in the light given by a mantle. So much is this the case, that some upholders of the catalytic theory, and notably some German mantle makers, have claimed that the illumination given by a mantle varies rhythmically or periodically, and that by proper manipulation in manufacture some mantles may be made even to increase in illumination while they burn. In order to test whether this variation is periodic or not, a mantle from a well-known German manufacturer, who claimed this property for his mantles, was tested side by side with a standard American mantle. The burner used in each case was a Welsbach No. 60, with an 8-inch cylindrical glass chimney; and the gas pressure was kept constant at 2 inches during the tests. Tests were made every 24 hours; the burner being set by repeated adjustment until it gave its maximum illumination in the direction measured. Record was kept of meter temperature, moisture in the air of the photometer-room, barometric pressure, heating value of the gas, and all other data which it was thought could be of service in interpreting the results, which are given in Table I. Diagram 1 shows graphically the relations existing between the two mantles.

TABLE I.—*Data of Daily Tests of Two Mantles.*

Days Burned.	Net Heat. Value of Gas in B.T.U. per Cub. Ft.	Atmos. Moisture. Grains per Cub. Ft.	Atmos. Pressure Millimetres.	American Mantle.				German Mantle.			
				Consumption. Cor. to 60° F. and 760 Mm.	Total Candles.	Candles per Cubic Foot.	B.T.U. per Candle-Hour.	Consumption. Cor. to 60° F. and 760 Mm.	Total Candles.	Candles per Cubic Foot.	B.T.U. per Candle-Hour.
0	580	5·0	743	3·45	73 8	21·1	27·5	4·50	64·6	14·3	40·6
1	571	5·6	744	3·36	70·6	21·0	27·1	4·15	67·3	16·2	35·3
2	584	5·7	742	3·54	66·8	18·8	31·0	4·15	73·4	17·7	32·9
3	576	5·5	735	3·60	66·2	18·3	31·4	4·17	72·2	17·3	33·2
4	581	3·6	744	3·32	66·6	20·0	29·0	4·03	73·1	18·1	32·1
5	570	3·2	744	3 34	66·9	20·0	28·5	4 19	73·4	17·5	32 6
6	605	3·5	734	3·25	67·8	20·8	29·1	3·84	75·7	19·7	30·6
7	578	3·3	737	3·49	63·7	18·2	31·7	4·19	69·9	16·6	34·8
8	576	3·1	745	3·62	65·4	18·0	32·0	4·02	71·6	17·8	32·4
9	590	3·2	744	3·45	67·5	19·5	30·2	3·99	72·7	18·2	32·4
10	590	3·7	742	3·36	62·5	18·6	31·7	4·13	70·5	17 0	34·7
11	581	3·3	747	3·56	63·2	17·7	32·8	4·24	69·1	16·3	35·7
12	578	2·8	751	3·48	63·9	18·3	31·6	3·90	64·6	16·5	35·0
13	585	2·9	737	3·67	69·5	18·9	30·9	3·90	70·6	18·0	32·5
14	593	3·4	736	3·43	63·9	18·6	32·8	3·91	68·5	17·5	33·9
15	604	4·7	740	3·67	68·5	18·7	32·3	3·62	68·5	18·9	32·0
16	589	5·8	726	3·43	60·6	17·6	33·4	4·12	63·2	15·3	38·5

By reference to Diagram 1, it will be seen that there are very marked and irregular fluctuations of candle power in both cases, and that after the first 48 hours the curves are in general parallel. The same irregularity and rough parallelism are observed in the curves showing the candles per cubic foot. The change in illumination is evidently a function of some variable outside of the mantle; for the chance that two mantles of entirely different makes should have the same apparently irregular period is a very slight one. The curve showing the net heating value of the gas indicates a factor which has influenced the result to a marked extent. The parallelism between the curves showing the candles per cubic foot and the net heating value of the gas is striking. It is not quantitative; but when the errors involved in setting the mantles at their highest illumination and in measuring their candle power are taken into account, the agreement is so good

* Though this paper was read at the meeting, it was withheld from publication owing to some of the experiments not having been completed. It has now been printed for distribution among the members.

† See "JOURNAL," Vol. LXXVII., p. 879; Vol. LXXIX., p. 892; and Vol. LXXX., p. 562.

that a close connection must be granted between the heating value of the gas and the illumination. This connection is merely an indirect one, due to the influence of changes in the composition of the gas upon the volume and temperature of the products of combustion; but this change is more correctly indicated by change in the net heating value than by any one other easily observed factor.

Another influence which undoubtedly affects the lighting value of the mantle is moisture in the air, the extent of which influence has, so far as we know, never been studied. We used as our photometric standard a 10-candle pentane lamp, which is known to be affected by moisture in the air; and it became important to obtain some indication of its relative effect on the mantle and the pentane standard. With this end in view, the moisture of the photometer-room was artificially changed by hanging wet cloths near the ventilating inlets, and moistening the floor and walls of the room; and a number of readings were made while the air became saturated with moisture, and also as the room dried again. The adjustment of the mantle was not changed during the experiment; and the pentane lamp was kept burning at the proper height. Determinations of moisture were made simultaneously with the photometric readings. No determinations of the carbon dioxide in the air were made; but its amount was kept constant as far as possible by not taking the photometric

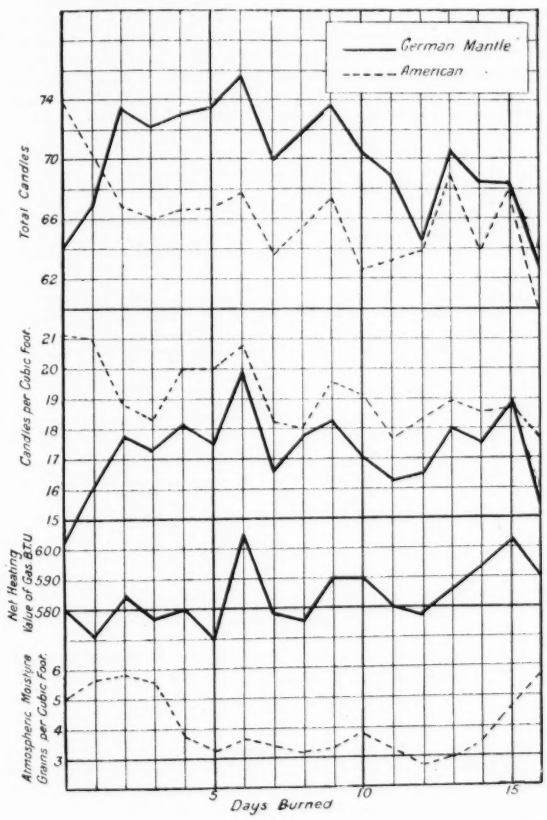


DIAGRAM 1.—INFLUENCE OF TIME OF BURNING, CALORIFIC VALUE OF GAS, AND MOISTURE IN THE AIR, UPON THE CANDLE POWER OF MANTLES.

readings until after the observers had remained in the room long enough to allow the conditions to become uniform.

After the first test, the walls were moistened, and the consequent changes in illumination observed. With the mantle tested, an increase of moisture was found to affect it more than the pentane standard; so that while its candle power with 3 grains of moisture to the cubic foot was 62, at 6 grains it had dropped to 60·4—a decrease of 0·53 candle per grain increase in moisture. A second series showed a drop of 0·46 candle for each grain increase; the points being on a straight line. This variation is not determined with sufficient accuracy to be applied quantatively; but it shows that the influence of moisture is a measurable one, working more to the disadvantage of the mantle than of the pentane standard. The influence of change in barometric pressure has not been investigated.

When examining in detail the curves of Diagram 1, the marked changes in candle power during the first two days are most striking. We have found such changes in the first few days' life of almost all mantles examined, and believe them to be due to the mantle shrinking and shaping itself to the flame. We have not found any uniformity in the direction of this change, even among mantles of the same make, and no importance is to be attached to the fact that in this particular instance one of the mantles increases and the other decreases in its illumination during the first two days. The deduction of general application to be drawn from this is that mantles which are to be tested for efficiency should be allowed to burn at least 48 hours, in order that they may have settled to a somewhat permanent state.

It will be noted that the position of the two mantles is reversed in the "illumination" and "efficiency" curves—the German mantle showing a higher candle power, but, on account of its looser texture, consuming more gas, and giving a lower efficiency, than the American mantle. After the second day, we find a general agreement in the fluctuations of the two mantles, which is best studied in the "candles per cubic foot" curve. An experimental error of half-a-candle per cubic foot cannot be considered exorbitant in this work, which involves setting for maximum illumination; and such a change made in the value of either mantle would be sufficient to bring about almost exact parallelism, except on the eighth day, where there has probably been an error in reporting the consumption of the German mantle. In trying to account for the variations in the "candles per cubic foot" curve, we shall take into account the heating value of the gas and the atmospheric moisture. The gas used was from the city mains. The wide variations in its heating value from day to day were due to the coal famine, which compelled the gas company to use widely varying amounts of carburetted water gas. These fluctuations make the work of adjustment more difficult; but, on the other hand, they also bring out the effects of such variations in the gas on its lighting value.

Referring to the "candles per cubic foot" curve of Diagram 1, and passing over the first two days' tests, for reasons previously mentioned, we find from the third to the tenth day that the efficiency varies with the heating value in a fairly uniform manner. An exception is to be made in the case of the eighth day, where there is undoubtedly an experimental error. The influence of the drop in atmospheric moisture on the fourth day is shown by the relatively large increase in efficiency as compared with the change of heating value. On the tenth day, there is a falling off in efficiency in both mantles, while the heating value remains unchanged. The increase of moisture on this day will partially, but not completely, account for this. Similarly, on the twelfth day, the low moisture and the extraordinary high barometric pressure account for at least part of the disagreement between the change in heating value of the gas and the efficiency of the mantles. On the fourteenth day, there is a disagreement for which we are unable to account. On the sixteenth a small, vertical crack, which had been present on the German mantle since the sixth day, increased so that the test was stopped.

These experiments give no support whatever to the "periodic" theory of the change in the mantle's illumination. The factor which has exerted the most influence on the mantle's illumination and efficiency has been the heating value of the gas, with the amount of moisture in the atmosphere ranking next in importance. These tests confirm the conclusions announced in previous papers, that, within the limits of composition of the gas for which a given burner is adapted, the efficiency of a given mantle will be chiefly a function of the heating value of the gas.

These mantles, in their test of only sixteen days, had not shown any marked diminution in efficiency. If we compare the candles per cubic foot at the end of the second and thirteenth days, the heating value being the same, we find little change in the figures. Nevertheless, there is no doubt that mantles do almost universally deteriorate; and we have confirmed this by the life-history of many mantles. Since the change cannot be ascribed to any periodic change in the mantle, the reason must be sought in some alteration in its physical structure or chemical composition. The changes in the mantle shown by the microscope have been studied with care by others, notably by Dr. Killing,* who has shown that the fine threads of oxides sinter together and shrink by long exposure to the flame. We have followed with photomicrographs the changes taking place in several mantles during their life. Some showed marked shrinkage, but in others we were scarcely able to find a change after 900 hours' burning; and we could not believe that this slight change was sufficient to account for the large decrease in illumination observed in these mantles.

There remained as a totally new field of experiment the changes taking place in the chemical composition of the mantle during its life. Such changes might be brought about by the deposition of a foreign substance on the mantle from the air or gas, or they might be caused by the removal of part of the material originally composing the mantle. The deposition on the mantle of iron oxide from iron carbonyl in the gas has been studied by others. Its presence is easily detected by the brown coating of ferric oxide on the mantle. We have noted its effects in only one case. When working with unpurified blue water gas, its harmful influence was shown in a very few minutes, by the drop in illumination and the appearance of a brown coating on the mantle. Iron carbonyl is not normally present in gas; and since deterioration due to it is so readily recognized, we have not studied its effects further.

A study of the change in the chemical composition of the mantle required a delicate method for the estimation of cerium in the mantle oxides which could be applied to samples of less than 100 milligrammes. The method finally adopted is based on that of E. Benz,† and is a calorimetric one, involving the oxidation of the cerium

* See "JOURNAL," Vol. LXXX., p. 1148.

† "Zeitschrift für Analyt. Chem.," 1902, p. 297.

salts by hydrogen peroxide in faintly ammoniacal citrate solution. The details of the method are as follows: For a standard we used a solution of mixed cerium and thorium nitrates, containing the equivalent of 0·0000344 gramme CeO_2 and 0·0034 gramme ThO_2 per cubic centimetre. This corresponds very closely to a N/5000 cerium solution. The mantle, or part of it, to be analyzed is fused with ten times its weight of sodium acid sulphate. The sodium is used in preference to the potassium salt, to avoid the formation of the difficultly soluble double sulphates of thorium and potassium. After fusion, the mass is dissolved in cold water, transferred to a 100 c.c. graduated flask, and diluted to the mark. An aliquot part of this, depending upon the weight and cerium content of the sample, is run into a Nessler tube, and used for the calorimetric comparison. This is most delicate when about 0·00015 to 0·0002 gramme of cerium is present in the solution. Nessler tubes, about 1 inch in diameter, answer very well. To another similar tube is added a 10 per cent. solution of sodium acid sulphate, corresponding in sulphate to the amount present in the solution to be tested. About 2·5 c.c. of a 25 per cent. solution of potassium citrate and from 10 to 15 drops of a 3 per cent. hydrogen peroxide solution are then added to both tubes, and the liquid brought to the same height. The volume should not be less than 50 c.c. Dilute ammonia is now added, drop by drop, until the solutions are faintly ammoniacal to litmus paper. The solution containing the mantle will be coloured yellow, due to the oxidation of the cerium, while the other will remain colourless. Care must be taken not to add too much ammonia, or the thorium will precipitate out, notwithstanding the presence of the citrate. The tubes are then set into black cardboard cylinders, so that all light is transmitted through the bottom. The standard cerium-thorium solution is now run into the standard tube from a burette, a few drops at a time, until, on looking down the tubes against a white surface, the colour appears the same. The standard tube must be shaken well after each addition. After the colours have been matched, it is best to destroy the colour in both tubes by acidifying with sulphuric acid, whereupon the cerium is reduced, and the solution decolorized. The solutions are then once more oxidized by adding a few drops of hydrogen peroxide and making them ammoniacal. On again comparing the colours, it is sometimes found that not enough cerium has been run into the standard tube. In this case the solutions are again brought to the same colour; and from the volume of standard solution used, the amount of cerium in the unknown solution is calculated. The thorium present makes the colour lighter; but it has been found that when it is present in ten times the amount of the cerium, additional thorium has no further effect on the colour. The standard solution used, containing thorium and cerium in the ratio of 100 to 1, will therefore answer for analyses of samples showing less than 10 per cent. of cerium.

We have found it better to use a single solution of thorium and cerium than to add to the standard tube the proper amount of thorium, oxidize, make ammoniacal, and then add cerium to the proper colour. In the latter case, it has been found that a considerable addition of cerium is almost always necessary in order to bring up the colour in the standard to that of the unknown after decolorizing and reoxidizing the solutions. The presence of iron interferes with this estimation of cerium, as it also produces a yellow colour, due to the formation of ferric salts. The minimum amount of iron which was found to have an appreciable effect on the colour is about 0·00004 gramme. Several mantles were tested for iron after long periods of burning; but no determinable amount was ever found, except in the case of the mantle above mentioned, which was tested with unpurified blue water gas. The method is a delicate one; and it is possible to detect the difference in colour of two solutions, due to the presence of 0·01 to 0·02 milligramme of ceria.

As an illustration of the accuracy to be expected in regular work, the results of eight analyses of mantles of known percentage of cerium are given:—

Cerium Present, Per Cent.	Percentage Found by Analysis.	
0·50	0·50	0·51
1·00	1·05	1·01
2·00	2·15	2·05
3·00	3·09	2·94

Analyses of mantles which had burned a long time showed that the percentage of cerium was less than in new mantles of similar brand, and that the cerium was no longer uniformly distributed throughout the mantle. In preparing an old mantle for analysis, the top half inch was rejected as probably containing foreign ingredients added to give it strength. The remainder was cut into four portions. The part that was clearly below the level of the burner cap was cut off and marked "bottom." Next a narrow band about one-eighth of an inch wide, which included the doubtful portion just at the level of the cap, was rejected; and then the rest of the mantle was cut into two portions, marked "middle" and "top." The middle section represented the part of the mantle most highly-heated; the top had not been subjected to such a high temperature; and the bottom, which had not been heated at all, represented the original composition of the mantle. This latter point was proved by the analysis of the bottoms of mantles of known initial cerium content after they had burned for long periods. Analyses of old mantles uniformly showed a lower percentage of cerium in the middle than in the top, and a lower percentage in the top than in the bottom.

As a typical case, we may cite a mantle of a well-recognized make which gave, when tested after 48 hours, 64 candles, or 16·6 candles per cubic foot. Tests made every two or three days showed a gradual diminution in illumination. After 29 days, when the heating value of the gas was almost the same as before, its candle-power had sunk to 47·8 candles, and its efficiency to 13·3 candles. It was still in good condition after the test on the 45th day; but a chimney breaking two days later spoilt it. The last photometric test made on a better gas than those mentioned showed 44 candles, and an efficiency of 12·9 candles per cubic foot. The analysis of this mantle after it had burned 1150 hours showed that the bottom contained 0·64 per cent. of cerium oxide, the middle 0·23 per cent., the top 0·28 per cent. The drop in illumination from 64 to 44 candles had been accompanied by a fall of from 0·64 to 0·23 per cent. in the cerium content of the highly-heated zone of the mantle.

That this decrease in the percentage of cerium is due to a real loss, and not to an increase of some other constituent taken up from the gas, was shown in two ways. First, a mantle was carefully weighed and started burning, and again weighed at the end of one, two, four, six, and eight days, when it broke. It lost weight steadily, and at the rate of approximately one milligramme a day during that time. Secondly, the deposits with which the insides of the glass chimneys became coated were washed off and collected for analysis. A sample of 84 milligrammes collected in this way contained 93 per cent. of sodium sulphate. In another sample of the deposit collected from several chimneys, the mixed thorium and cerium compounds were precipitated as oxalates, filtered, ignited to the oxides, and the cerium determined colorimetrically. This was found to be 26 per cent. of the combined oxides. Whereas in the mantle the ratio of thorium to cerium

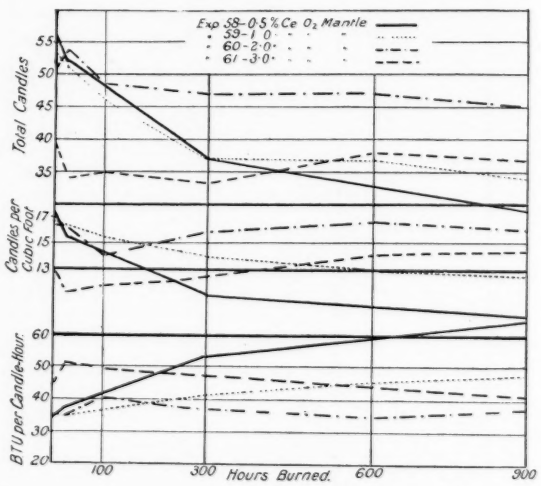


Diagram 2.—Influence of Different Percentages of Cerium and the Calorific Power of Gas on the Efficiency of Mantles.

oxide is about 100 to 1, in the chimney deposit it is 3 to 1; showing conclusively that the cerium volatilizes more rapidly than the thorium. Another sample of chimney deposit examined in the same way showed 12 per cent. of oxide of cerium.

It has been shown by experiments on many different mantles that the decrease in illumination is always accompanied by a reduction in its percentage of cerium. The variations in the physical properties, and the methods of manufacture of mantles from different makers, render it impossible to draw any conclusions as to the quantitative relation between the decrease in cerium and the fall in illumination. In order that we might test this point, the Welsbach Company kindly manufactured for us a set of mantles which were alike except in the percentage of ceria. One lot of mantles were pure thoria, and the other contained 0·5, 1, 2, and 3 per cent. of ceria, respectively. Tests were carried out on these mantles burning side by side; two separate series being made for 900 hours. When the tests were stopped, the mantles were analyzed. The data are given complete in Tables II. to V., and the photometric results of one series are shown graphically in Diagram 2. In both series, the candle power decreases rapidly with the 0·5 per cent. ceria mantle; less rapidly, but still markedly, with the 1 per cent.; decreases slightly with the 2 per cent.; and increases with the 3 per cent. The candles per cubic foot change in the same way. The marked difference in the heating value of the gas in the two series makes direct comparison difficult; but this may be partially eliminated by calculating the illumination as a function of the heating value alone, and plotting British thermal units per candle-hour. In this method of plotting, a rise in the curve means a decrease in efficiency. This is also shown in Diagram 2. The more rapid deterioration of the mantles with the low cerium content, and the actual improvement of those with the high percentage of cerium, are now evident.

TABLES II. TO V.

Hours Burned.	Net Heat Value of Gas. B.T.U. per Cub Ft.	Exp. 58—0·5 per Cent. CeO_2 Mantle. Consumption, Cor. to 60° F. 760 Mm. Cub Ft	Total Candles.	Candles per Cubic Foot.	B.T.U. per Candle-Hour.	Exp. 59.—1 per Cent. CeO_2 Mantle. Consumption, Cor. to 60° F. 760 Mm. Cub. Ft.	Total Candles.	Candles per Cubic Foot.	B.T.U. per Candle-Hour.
..	595	3·29	56·9	17·3	34·4	3·27	54·6	16·7	35·6
24	585	3·33	52·1	15·6	37·4	3·14	51·6	16·4	35·6
100	586	3·34	47·6	14·3	41·1	2·96	46·0	15·5	37·7
300	593	3·34	37·1	11·1	53·4	2·64	37·1	14·1	42·2
600	594	3·28	33·0	10·1	59·0	2 85	36 8	12·9	46·0
900	603	3·11	29·1	9·4	64·4	2·72	34·1	12·5	48·1

		Exp. 60.—2 per Cent. CeO_2 Mantle				Exp. 61.—3 per Cent. CeO_2 Mantle.			
..	595	3·12	51·2	16·4	36·2	3·02	40·0	13·2	44·9
24	585	3·30	54·0	16·4	35·7	3·04	34·4	11 3	51·6
100	586	3·38	48·2	14·2	41·1	2·96	35·0	11·8	49·5
300	593	2·96	47·0	15·9	37·4	2·69	33·4	12·4	47·8
600	594	2·81	47·1	15·7	35·4	..	..	..	..
600	625	..	..	..	..	2·69	38·1	14·2	44·2
900	603	2·83	45·4	16·0	37·6	2·55	36·7	14·4	41·6

		Exp. 63.—0·5 per Cent. CeO_2 Mant e.				Exp. 64.—1 per Cent. CeO_2 Mantle.			
..	603	3·53	56·2	15·9	37·9	3·40	59·1	17·4	34·7
24	586	3·27	51·9	15·8	36·0	3·19	58·9	18·5	31·7
100	595	3·27	48·3	14·8	40·3	3·20	57·5	18·0	33·2
300	599	3·17	43·1	13·6	44·0	3·05	50·2	16·5	36·4
600	625	3·07	36·4	11·9	52·7	3·13	49·6	15·8	39·5
900	628	3·20	38·6	12·1	52·1	3·06	42·8	14·0	44·9

		Exp. 65.—20 per Cent. CeO_2 Mantle.				Exp. 66.—3 per Cent. CeO_2 Mantle.			
..	603	3·00	51·6	17·2	35·1	3·08	44·8	14·5	41·5
24	586	2·92	48·9	16·7	35·0	3·13	38·3	12·2	47·8
100	595	2·76	48·2	17·5	34·1	2·92	39·3	13·4	44·2
300	599	2·82	48·1	17·1	35·1	2·91	38·4	13·2	45·5
600	625	2·64	44·0	16·7	37·5	2·80	39·1	14·0	44·8
900	628	2·69	46·5	17·3	36·1	2·78	39·3	13·7	44·3

In the analysis of these mantles, the top, middle, and bottom were analyzed separately, as before explained; and the results are given below. In the 900 hours' burning, the cerium in the hot zone had dropped to from 40 to 60 per cent. of what it initially contained.

TABLE VI.

Mantle. Per Cent.	Experiment Number.	Percentage of Ceria. Bottom.	Middle.	Top.
0·5	58	0·51	0·21	0·39
0·5	63	0·50	0·32	0·42
1·0	59	1·05	0·43	0·79
1·0	64	1·01	0·37	0·72
2·0	60	2·05	0·71	1·37
2·0	65	2·15	0·88	1·50
3·0	61	2·94	1·56	2·66
3·0	66	3·09	1·51	2·40

The relation between the final cerium content in the middle of the mantle and the illumination is best expressed graphically by plotting the cerium content and the B.T.U. per candle-hour of the last test. The curve is shown in Diagram 3. It is approximately a parabola, with vortex, the point of highest efficiency, about 1 per cent. cerium content, and the efficiency decreasing in both directions with change in the percentage of cerium. This is in general accord with the well-known facts about the efficiency of different mixtures of thoria and ceria. As the mantles are no longer homogeneous, it is out of the question to compare the results with those that are obtained from new mantles. This series of mantles showed clearly what had also been noted in commercial mantles—that the decrease in the percentage of cerium changed the colour of the light. With a higher percentage of cerium, the light is yellow. As the cerium drops to about 1 per cent., the light becomes more nearly white; as it falls below 1 per cent. it becomes more of a green.

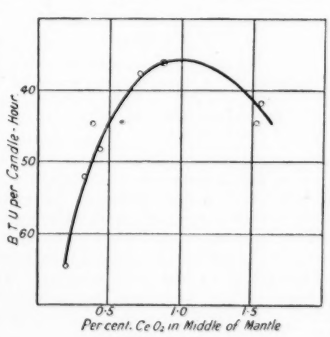


DIAGRAM 3.

Our earliest tests were made entirely on American mantles; but later we obtained, through the kindness of Dr. Bunte, a number of samples of three of the best-known German makes. These came to us already burnt off and shellacked. The manufacturers claim that shellacking injuries the illuminating power; but as American mantles are all put on the market in this form, it was deemed fair to use the shellacked German mantles. With the mantles came some of the German Auer burners; and an attempt was made to test them according to the methods of the German commission which prescribe that a 10-inch chimney shall be used, and that the pressure shall be varied between 1·2 and 1·4 inches, and the consumption between 3·5 and 4·4 cubic feet, until the highest illumination is obtained. The Auer burner does no possess any way of regulating the air or gas supply, except as the latter may be regulated by turning the fixture key, which effects a corresponding change in the pressure. We found that the air supply was too great for our gas, and that it was necessary to put metal collars round the burners to control the air supply.

We also found that we could not get the right amount of gas through the burner at the low pressure specified. The German regulations direct that a proper tip shall be chosen by trial to give the maximum light. No series of tips came with the burners, and we employed them as they were furnished to us. This necessitated the use of a 2-inch pressure. The burner was set for the highest illumination each time by regulating the air supply. An attempt was made to run a parallel series, keeping the consumption constant at the amount determined to be proper for the first day. But the light could not be kept steady on some days, and this test was abandoned. Tests were also made with the mantles on American burners. The mantles on the American burners started higher, but deteriorated more rapidly. These phenomena are probably associated. The adjustable air and gas supply allowed a more perfect regulation of the conditions of combustion, giving a higher temperature and more light, with correspondingly rapid deterioration. One of the German mantles actually made good its claim of increasing in illumination for more than 1000 hours. The curve shows the usual irregularities; but a fair line struck through the points shows a distinct increase both in candles and candles per cubic foot during the 52 days' burning. The photometric results are given in Table VII. Unfortunately, an accident in the analysis of this mantle prevents us giving the chemical composition after burning; but that of the new mantle was 1·27 per cent. of ceria.

TABLE VII.

Days Burned.	Consumption. Cub. Ft.	Net Heat Value of Gas. B.T.U. per Cub. Ft.	Atmos. Mixture. Grains per Cub. Ft.	Illuminating Power. Candles.	Candles per Cub. Ft.	B.T.U. per Candle-Hour.
..	3·54	593	3·4	60·3	17·0	34·9
1	3·45	591	3·3	60·4	17·5	33·7
5	3·42	582	3·2	61·5	18·0	32·5
9	3·46	585	4·6	62·9	18·2	32·1
13	3·32	583	4·7	57·2	17·2	33·8
16	3·45	578	5·4	60·7	17·6	32·8
20	3·56	579	3·6	63·5	17·8	32·5
23	3·51	589	3·5	66·2	18·8	31·2
27	3·38	585	3·9	62·4	18·5	31·7
33	3·39	579	2 9	60·3	17·8	32·5
37	3·56	578	3·1	64·7	18·2	31·8
46	3·35	579	4·0	62·5	18·7	31·0
52	3·45	591	4·5	61·4	17·8	33·1

In considering the reasons for the volatilization of the cerium, it did not seem impossible that a marked deficiency of air supplied to the burner might cause carbon monoxide in a strongly reducing atmosphere to form a volatile cerium carbonyl. To test this, a mantle was started with the air supply so restricted that there was a very noticeable flame envelope outside the mantle. Under these circumstances, the mantle gave a poor light, and was evidently at a low temperature. For photometric measurements, it was brought back to its normal method of burning. After burning for 42 days in this manner, the mantle retained its original candle power and efficiency unimpaired. It was then burned with a proper air supply, with the result that an immediate deterioration was noted. After burning 23 days more, it was stopped—having burned in all 1560 hours. In the last period of 23 days, it dropped from 61 to 42 candles; and its efficiency fell from 19 to 12 candles per cubic foot. The analysis of this mantle showed in the middle 0·39 per cent. of cerium; while the bottom, representing the original composition of the mantle, contained 1·05 per cent. The photometric results indicate that this loss of cerium took place almost entirely in the second period, when the mantle was burning properly. A deficient air supply, so far from impairing the mantle, seems to have preserved it during the first period, by keeping its temperature below that at which the cerium volatilizes.

It seemed also possible that sulphur compounds in the gas, forming sulphurous and sulphuric acids in combustion, might be responsible for the loss of cerium. The very large percentage of

sodium sulphate in the chimney deposits lent colour to this idea. As no way presented itself of readily removing the organic sulphur always present in the gas, the influence of an excessively large amount of sulphur was studied. For this purpose, hydrogen sulphide was introduced into the gas in amount about equal to 100 grains of sulphur per 100 cubic feet—an amount ten times greater than that normally present. Tests on two mantles burnt under these conditions failed to give any evidence of abnormally rapid deterioration. We cannot, therefore, ascribe any marked influence to the presence of sulphur.

The suggestion has been made that the use of water gas is responsible for the more rapid deterioration of mantles in this country than in Germany. We have not had available a continuous supply of water gas; but tests made by the kindness of Mr. A. F. Traver, of the Grand Rapids Gas Company, indicate that water gas does not necessarily exert a harmful effect. In a test of two similar mantles, one burning carburetted water gas of an average candle power of 25, and the other coal gas of 15-candle power, the mantle on water gas, after 24 hours' burning, was giving 115 candles, or 32·9 candles per cubic foot, and after 1150 hours was still giving 91 candles, or 21·2 candles per cubic foot. The mantle burning on the coal gas, after 24 hours, gave 96 candles, or 21·3 candles per cubic foot, and after 1272 hours 72 candles, or 14·4 candles per cubic foot. Both mantles remained in good physical condition until breaking chimneys stopped the tests. The much higher candle power of the mantle burning rich water gas is confirmatory evidence of the influence of the heating value of the gas on illumination. Although this mantle stood the test of continuous burning on water gas without visible physical deterioriation, some mantles have shown a marked tendency to crumble at the level of the cap in the intense heat of the water-gas flame. It is a more severe test of a mantle to subject it to a very hot flame than to keep it at a lower temperature.

Our study of the deterioration of mantles while burning leads us to the following conclusions: The physical changes taking place in well-made mantles are relatively unimportant; the greatest cause of the gradual deterioration being the loss of cerium oxide, which slowly volatilizes in the intense heat. Experiments on mantles containing originally more than 1 per cent. of cerium indicate that their efficiency increases until the cerium content of the hot zone has dropped to about 1 per cent. From this point onwards, they deteriorate. The rate of deterioration of commercial mantles varies greatly; but the important factor is still the decrease in the percentage of cerium. Some mantle manufacturers are able to very greatly lessen the rate of loss of cerium, and thus make mantles which retain their efficiency for long periods. Our experiments do not support the theory of periodic change in the mantle's illumination, but confirm the position previously taken, that the alteration of the heating power of the gas, with its consequent effect on the temperature of the mantle, is the most important factor in causing the fluctuations in the illuminating power of a mantle from one day to the next, The amount of moisture in the atmosphere also exercises an appreciable influence.

PUBLIC LIGHTING IN WEST BROMWICH.

With a view to improving the lighting of the tramway routes of West Bromwich, late in 1902, a resolution was passed by the Highway Committee, and approved by the Town Council in January, requesting the Gas and Electricity Committees to each undertake, for a period of three months, the experimental lighting of five or six of the centre tramway poles in the main thoroughfare of the town; and, at the end of the three months, to report to the Highway Committee on the cost of the experiment, and to submit prices at which they would be prepared to undertake the permanent lighting of the tramway routes on their respective systems. The matter has stirred up considerable interest locally—among the public, in the Press, and at the Council meetings; and from the reports made on the subject to the Council, a large amount of information is gathered.

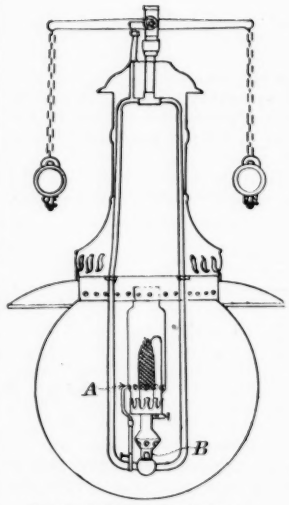
After a succession of difficulties and delays, owing, it seems, to objections by the Highway Committee to the use of any high-power gas-lamps (why, is not clear), the experiment was inaugurated on the evening of March 9. Five of the poles were lighted by gas; the first being situated in the centre of Dartmouth Square, on which pole two 700-candle power "Lucas" lamps of the "arc" pattern were suspended by means of two wrought-iron brackets. On each of the next two poles, two double-burner "arc" pattern "Astral" lamps were fixed, controlled by duplex taps, so that either one or both burners might be turned on or off at will. The two remaining poles were lighted by four single burner lamps of similar pattern, with two lamps on each pole as before.

After a number of experiments with various burners and mantles, a modified form of the "Luba" burner was selected, with which an efficiency of 23·5 candles per cubic foot was obtained at a pressure of 15-10ths and a consumption of 4·9 cubic feet per hour. It was found that mantles having a somewhat coarse mesh, woven with fine thread, gave the most brilliant light with these burners. The mantles used were 4½ inches in length, quite 4 inches of which were fully incandescent under the above conditions. Each of the smaller lamps was suspended from the bracket by a cup-and-ball joint, and one of Shaw's "Dermatine" cushion anti-vibrators—the former to take up the lateral, and the latter the vertical vibration. This arrangement has proved to be most effective as regards economy in mantles; the renewals averaging one per burner, in spite of continuous heavy winds and difficulty of access for cleaning (which was mainly responsible for the renewals that were required), and, further, the mantles were changed when the smallest defect was observable. The chimneys were the ordinary 10-inch "Normal" pattern. Through one of the holes in which the bye-pass tube was led, a small clay shield was used to protect the pilot-jet from the effect of the draught passing through the holes in the base of the chimney.

DOUBLE-BURNER LAMPS.

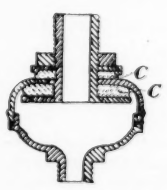
LUCAS LAMPS.

THE GAS-LAMPS ATTACHED TO THE TRAMWAY STANDARDS.



SHAW'S PATENT ASTRAL "ARC" LAMP.

A. Clay shield. B. Cam for regulating gas; a quarter turn opens or closes the four outside holes in succession—the centre hole being always open.



SHAW'S PATENT ANTI-VIBRATOR.

C. Dermatine cushion.

The Electricity Department installed lights upon six of the poles—leaving two unlighted between them, and the last or fifth pole bearing the single-burner gas-lamps. At first, 25-candle power incandescent lamps were used in clusters of three on each side of the poles, and enclosed in prism globes; the current being obtained from the trolley wire. The result when these were turned on was dismal in the extreme; and so steps were immediately taken to instal two double enclosure arc lamps on the pole nearest to the single-burner gas-lamps. These gave an improved, although still unsatisfactory result. Cables were then laid in order to place the lamps in the lighting circuit; and two new single enclosure "Davy" arc lamps were fixed on each of three poles—one being adjacent to the low-power gas-lamps as

before. The "Davy" lamps give an excellent light within a radius of (say) 40 or 50 feet; but beyond that the Lucas lamps have an undoubted advantage.

With regard to the cost of conducting the experiments, whereas those for gas lighting have been given in detail, those for the electric lighting are not yet forthcoming. But this is not a matter for surprise, considering the large number of times the electric lamps were changed.

Price Quoted for Public Lighting by Gas Per Lamp per Annum.

(1) If the Gas Committee provide and fix lamps.
(2) If the Highway Committee provide and fix lamps.

	(1) £ s. d.		(2) £ s. d.
700-candle power Lucas lamps . .	5 14 6	..	4 15 2
200-candle power double lamps* . .	3 3 9	..	2 15 6
100-candle power single lamps . .	2 6 4	..	1 19 9

* One burner in each lamp to be extinguished at 11 p.m.

The present charge for gas to the Highway Committee for street lighting is 1s. 1d. per 1000 cubic feet, which is the actual manufacturing cost. The Gas Committee having expressed their intention of endeavouring to get this charge raised to 1s. 9d., the Highway Committee have, in their report to the Council, taken the latter as the price of gas, bringing the costs for gas lighting to the following figures:—

	(1) £ s. d.		(2) £ s. d.
700-candle power Lucas lamps . .	7 19 2	..	6 19 10
200-candle power double lamps* . .	4 1 9	..	3 13 6
100-candle power single lamps. . .	2 19 2	..	2 12 7

* One burner in each lamp to be extinguished at 11 p.m.

The Electricity Committee's quotation for 1000-candle power arc lamps, with current at 1d. per unit, not including separate cable, is £10 per lamp per annum, with a rebate of 25 per cent., to be given out of the profits of the undertaking. The price to be charged for current will thus be 0·75d. per unit. The consumption of the 1000-candle power arc lamps is also taken at 700 watts, or less than ¾ unit per hour each.

The fact was made public at the Council meeting that, whereas the quotation for gas was for 3940 lighting hours per annum, that for the electric arc lights was for an average of four hours per night, after which, two incandescent 25-candle power electric lamps are to be turned on upon alternate poles (which are 40 yards apart). So that the street, after eleven p.m., will be "lighted" by 50-candle power (when the lamps are new) every 80 yards. This will be considerably less than half the present light; so that the lighting hours per annum will be 1460 for the arcs, and 2190 for the incandescents, making 3650, as against 3940 for gas.

To sum up, the Electricity Committee's offer, which was accepted, was to place two arc and two incandescent lamps upon every other pole between Beeches Road and Carters Green, to be lighted for the above number of hours respectively, for £600 per annum. The Gas Committee offered to put two Lucas lamps upon every other pole for £435, or two double burner lamps on each pole (one burner to be checked at 11 p.m.) for £484, or two single-burner lamps on each pole for £352, for the full number of 3940 lighting hours per annum, calculated, of course, on the present price of gas for public lighting purposes—viz., 1s. 1d. per 1000 cubic feet.

COMPRESSED AIR FOR RAISING WATER FROM DEEP WELLS AND BORINGS.

By W. H. Maxwell, Assoc.M.Inst.C.E., of Tunbridge Wells.

[From a Paper and Discussion at the Annual Meeting of the British Association of Water-Works Engineers.]

In introducing his subject, the author mentions that an air-lift pumping plant was installed at the Tunbridge Wells Corporation Water-Works in 1900; and it has been in constant use since. Before referring to the details of this particular plant, he reviews some of the general principles governing the operation of compressed air in raising water. The experiments carried out in the United States by Dr. Pohlé, of Arizona, have proved that the main principle upon which the system operates is the following: Air under the necessary pressure and of suitable volume is admitted to the bottom of a pipe immersed in the water to be lifted. By this means, alternate bands or columns of air and water are formed in the water-pipe or rising-main; and the air does not, as might perhaps have been anticipated, pass through the mass of water. The result of this is that the aggregate weight of the water in the rising-main is insufficient to balance the column of water in the boring; and the pressure of the latter therefore produces an upward movement of the air and water column in the rising-main. As the force lifting this column is the head of water, it follows that the height to which the water can be lifted depends upon the depth to which the pipe is immersed below the pumping level of the water in the boring. Thus, the higher the lift required, the deeper must be the point at which the air is injected relatively to the normal water-level therein; and, consequently, the height to which the water has to be raised determines the minimum depth to which the boring must be driven.

With regard to the best proportion between the immersion of the air nozzle and the lift of the water, opinions vary; but the author has found that in his case the most economical result was obtained when the ratio was 3 (of immersion) to 1 (of lift) at the start, and 2·2 to 1 at the finish of the test. Under these conditions, the efficiency worked out at 36·8 per cent. calculated from the steam diagram, and at 46 per cent. calculated from the compressor diagram; the volumes of air used and water lifted being in the proportion of 2·69 of the former to 1 of the latter.

With regard to the quantity of air required to lift a given volume of water to any specified height, the following formula is found to give results in accordance with his own experience: X = cubic feet of free air per minute; A = gallons of water required per minute; and B = lift of water in feet—$X = \frac{A \times B}{125}$. From this formula it is a simple matter to ascertain the quantity of water that can be lifted to any given height by a given quantity of air.

With regard to the proportions between the areas of the air-pipe and the rising-main, the author considers that further experiments are required before it can be decided what proportions will secure the most economical results in practice. It is evident that the velocity of the water in the rising-main is an important factor in this case; but, as regards the air-pipe, the author considers that the velocity of the air should not exceed about 20 feet per second.

It has occurred to the writer, as it has no doubt to others who have watched an air-lift plant in operation, that the excessive velocity and force of the discharge must involve a considerable waste of energy, and that some appreciable economy would be effected were it possible to utilize this force in any practical way. In considering the design of the compressor, it is obviously important in the interests of economy to provide either two-stage or three-stage machines (with intercoolers), according to the amount of compression required. Thus, for pressures above 60 lbs. per square inch and up to 300 lbs. per square inch, two-stage machines are most suitable; and from this to 1000 lbs. per square inch, three-stage machines are desirable. The cooling of the air is also of great importance in this respect, and care should be taken to start with an air supply at the lowest temperature obtainable.

The main factor which influenced the decision to apply the air-lift system at Tunbridge Wells was the possibility of operating the boring from the existing pumping-station, and avoiding the erection of any buildings, foundations, or machinery requiring personal supervision at the site of the boring, which is situated some 530 yards away from the pumping-station. The boiler power was also sufficient to supply the steam required for the compressors without any additional boilers, settings, or buildings for same; and the air-compressing plant involved no extra attendance, as a new steam pumping plant was then being installed, and one extra mechanic was able to attend to both sets of plant.

The compression is carried out in two stages—the first, to a pressure of 25 lbs. per square inch; and the second, after intercooling, to the pressure required, which varies from 90 to 100 lbs. per square inch, according to the depth of the water in the boring. The air is delivered into a large steel receiver situated in the engine-house, whence it is conveyed to the wells by means of a 4-inch cast-iron pipe. There are two sets of engines and compressors designed to deliver a sufficient volume of air to lift the desired quantity of water, if needs be, over a stand-pipe 20 feet high above ground level. The engines are compound, with cylinders 8 inches and 12 inches diameter respectively; the air-compressing cylinders being 10 inches (first stage) and 6 inches (second stage) diameter respectively. The stroke in each case is 14 inches. The air-cylinders are water-jacketed at the sides and covers. The clearance in the air-cylinders does not exceed 1 per cent. of the capacity. The air is drawn from outside the building, and is carried in an earthenware pipe under the floor to the inlet-valves; so that it enters the compressors at the lowest possible temperature. The intercooler (between the first and second stages of the compressors) is formed of a series of "Rows" tubes cooled by circulating water. Provision is made for draining off the water which is precipitated in the receiver owing to the compression of the air; and, similarly, any oil carried forward by the air from the cylinders is also precipitated here, and drained away from time to time. As a further safeguard, another trap is provided near the boring for the same purpose. In some cases, however, the receiver is filled with coke in order to arrest any oil carried forward with the air.

The boring is 350 feet deep; the upper portion being lined with 15-inch steel tubes, and the lower portion (150 feet) with steel perforated tubes, 13½ inches diameter. The rest-level of the water is about 96 feet from the surface; and the pumping-level, when drawing at the rate of 32,000 gallons per hour, is about 120 feet from the surface, but, on the cessation of pumping, the water resumes its rest-level very rapidly. The water-pipe or rising-main is 7 inches diameter, and is carried to within a few feet of the bottom of the boring. The air-pipe was originally 1½ inches diameter, but was subsequently increased to 2½ inches diameter—an alteration which reduced the air pressure required from 105 lbs. to 91 lbs. per square inch; the latter figure corresponding very closely to the head of water above the bottom of

the air-pipe, and thus proving the loss by friction to be reduced to a minimum.

In a trial run for 10¾ hours made soon after the plant was installed, an average of 31,402 gallons per hour was raised from this boring under a head of 133 feet; whereas an ordinary single-acting pump, such as could be fixed in a boring of this small size, would not give more than about 18,300 gallons per hour.

The cost of the plant, including two compressors with compound engines, air-main, air and water pipes in borings, condenser-feed and air-pumps, was £3374 17s. 6d.

The author gives a table summarizing the results obtained by tests at various times and under different conditions of water-level. In trial No. 1, it is seen that the most favourable result was obtained when the proportion of immersion of air-pipe to lift of water was 3 to 1 at the start and 2·2 to 1 at the finish; the volume of air used per volume of water lifted being in the proportion of 2·69 to 1. The efficiency in this case was 36·8 per cent. calculated on the water raised proportionate to the indicated horse power developed in steam-cylinders, and 46 per cent. calculated from the indicated horse power shown by air-cylinder diagrams. Unfortunately, on this occasion the fuel consumption was not recorded; so that the cost per 1000 gallons of water raised could not be obtained. From trial No. 5, however, with a much less immersion of air-pipe, and when the proportion of air used to water lifted was more than double that in the former case, the cost of fuel worked out at 1·073d. per 1000 gallons for a maximum lift of 125 ft. 9 in.; the price of coal being 25s. 5d. per ton. During the earlier months of this year, with water-levels varying between the depths of 98 and 118 feet below the surface, under regular working conditions, the fuel cost came out at a fraction under a penny per 1000 gallons raised. In trial No. 7, the efficiency worked out at 26·1 per cent. on the steam-cylinder diagram, and 32·5 per cent. on the air-cylinder diagram.

Having to provide pumping plant for a boring 15½ inches diameter and 400 feet deep, situated in an isolated and somewhat inaccessible position, the author has made a careful estimate of the comparative cost of pumping and maintenance with the three alternatives of (1) air-lift, (2) steam-engine, and (3) oil-engine—both the latter operating ordinary borehole pumps, and in each case taking into account the capital charges involved. The results are shown in the following statement; the lift being assumed as 100 feet, and the working hours 3000 per annum.

1.—Compressed-Air Plant.

	Per 1000 Gallons.
Capital charges, labour, and repairs	1·160d.
Fuel, as per test Oct. 7, 1902	1·073
Total	2·233d.

2.—Steam-Engine and Borehole Pump.

Capital charges, labour, and repairs	2·4d.
Fuel (average of tests by the author)	0·5
Total	2·9d.

3.—Cheap Fuel Oil-Engine Plant and Borehole Pump.

Capital charges, labour, and repairs	1·53d.
* Crude oil fuel	0·25
Total	1·78d.

* At a trial of a crude oil-engine plant, working at Granton, the cost of fuel averaged only 0·183d. per 1000 gallons raised 100 feet; the price of crude oil being 2½d. per gallon.

In conclusion, the author summarizes some of the most important general features of the air-lift system as ascertained from his own experience. The most suitable conditions under which the system may be applied appear to be those which exist at Tunbridge Wells—viz., where a boring is situated in an isolated and somewhat inaccessible position and the air-compressing plant can be placed on an existing pumping-station, involving but little outlay in the erection of new foundations or buildings, or the purchase of additional land, and without incurring the provision of additional labour at the site of the boring. To secure satisfactory results, however, it is important that the difference between the rest-level and the pumping-level of the water should not be excessive, that the fluctuations of the same should be ascertained beforehand, and that the ratio between the immersion of the air-pipe and the total lift of the water should be adjusted to the most suitable proportions, and not greatly varied in ordinary working.

Although it cannot be denied that the cost of fuel involved by the air-lift exceeds that required with a steam or oil driven pump of the ordinary form, yet the author believes that, under suitable conditions, the former will prove to be preferable, taking all charges into account in each case. The absence of any moving parts in the boring secures a great reduction in the cost of repairs and maintenance, as well as in supervision and all other charges incidental to an additional pumping-station. There is also a great advantage in the use of the air-lift in cases where the water contains iron, as the aëration is carried out very thoroughly in the boring; and, after the water has reached the surface, the precipitation of the iron takes place more speedily. On the other hand, the system is by no means suitable to all circumstances, and should not be resorted to unless the conditions of working are specially favourable to its use.

Discussion.

Mr. C. H. W. Biggs (London) said he should like this question reduced to mathematics. The efficiency of a system of this kind, it seemed to him, did not vary proportionately to the depth from which the water had to be raised; but in principle it increased as the square of the depth. If this was correct, the air-lift would be utilized to a greater extent than it was to-day.

Mr. J. W. M. Richardson (Birkenhead) remarked that they had at the Birkenhead Corporation works a plant of this description; but he could not say much about it, as they were in dispute with the contractors as to its economical utility. He could, however, give a few particulars as to sizes and capacity. The plant, in a series of eight trials, with a run of 168 hours, averaged 47,704 gallons per hour. The air-tubes were 3 inches in diameter, and were down to a depth of 467 ft. 7 in. The water-tubes were 10 inches in diameter, and were down to a depth of 762 feet in the borehole, which was 30 inches and 24 inches in diameter, and 800 feet deep. The average air-pressure in the receiver was about 118 lbs. per square inch. The water-level in the borehole was 200 feet from the surface; and their standing level was about 16 feet below the surface, so they were really working at a disadvantage. The author mentioned the cooling of the air. This, he (Mr. Richardson) thought, would be a distinct advantage; and he did not think that, in their own case, it was cooled sufficiently. Reference was also made in the paper to the straining of the air through coke—possibly by filling the air-receiver with it—to arrest any oil carried forward; and this he also considered a good idea. He had found, when the air-tubes were lifted after working some six or eight months, that they were coated both on the outside and inside with grease that had been carried down through the receiver; and, of course, this sort of thing would tend to make matters worse.

Mr. G. Hodson (Loughborough) regarded the paper as a very practical one. The chief point that occurred to him in estimating the value of the compressed-air plant was that, in the case of Tunbridge Wells, where they were in great difficulty in regard to getting the requisite quantity of water, they could pump up something like 768,000 gallons a day with compressed air; whereas, with a borehole pump, they would have had to be content with 430,000 gallons. This increase in the quantity of water compensated very fully for the little extra cost of the fuel, and made it, to his mind, a most extraordinarily economical plant. The hard fact that Mr. Maxwell could get something like 75 per cent. more water out of the borehole than he could by any other means was certainly a great advantage in favour of the plant. However, he (Mr. Hodson) should say that, as a rule, in his opinion, compressed air was applicable in very few cases. Where they had a large well, and could put in large pumps and use steam economically by triple expansion and condensation, here, of course, air compression did not come in. But where a borehole was situated some distance from the other plant, it saved the cost of additional buildings, plant, and cost of supervision, which would, roughly speaking, quite equal the cost of fuel. So that this Tunbridge Wells instance was one in which compressed air could be economically applied.

Mr. C. H. Chapman (Pendleton) said that, considering the depth of the borehole and the relative water-levels, the author appeared to have got a very satisfactory result, both as to the working cost and the quantity of water raised. He (Mr. Chapman) had had to do with three air-lift plants very recently—two in Manchester and one at Penistone for the District Council; and he thought they had proved in one case that they obtained just as good a result as to the quantity of water raised, running the compressor at 90 revolutions, as they did at 120 revolutions. The plant at Penistone was of more importance. In this case, the borehole was 400 feet deep, and 13 inches in diameter. The rest water-level was about 20 feet below the discharge of the water-tube, which was 6 inches in diameter. The length of the water-tube was 155 feet; and the air-tube (1¾-inch), 150 feet. With a boiler-pressure of 68 lbs., and an air-pressure in the receiver of 52 lbs., the quantity of water raised into a tank just below the surface was 340 gallons per minute. The water-level in the borehole was reduced 20 feet. It was then forced into a service reservoir about 260 feet above, at a total fuel cost of less than 0·9d. per 1000 gallons. In this case, of course, the borehole conditions were known to be very favourable; and he believed that the working cost could be even further reduced. He thought there was a great deal to be said in favour of the air-lift system if the conditions of the well were favourable; and it was always an easy matter to alter the air-tube as circumstances required. There must be some proper proportion between the diameter of the air-tube and the rising-main; and this he thought was dependent on the height of the lift.

Mr. Amos E. Black (London), in a written communication, pointed out that the author said the air did not pass through the column of water. As a matter of fact, this was exactly what it did do; and, when the water column was aërated, the equilibrium was disturbed, and the water flowed. This was no doubt what Mr. Maxwell meant; but he (Mr. Black) thought he hardly said it. The great struggle was indeed to get the air-nozzle which, from the manner of the outlet, would induce the most efficient aëration of the column. Hence Sterling's fine-spray outlet and Pohlé's big-bubble outlet. The claim of the American was that the economy of this system consisted in confining the water casing, so that the whole expansive power of the air was utilized upward.

As the lifting increased, the water casing was greater, in order to prevent the escape of the air through the water; and the water was emitted alternately with air pistons. Hence the extravagance of the system for long lifts and small submergence, as the air then lifted unaërated water, compared with an aërated column in the other case. It was, however, an error to make a remark similar to that with which the author ended the Pohlé paragraph. Of course, there were limits; but it was possible to lift the water from a 500 feet well where the normal level was 100 feet from the surface, and the working level 400 feet from the surface. He had an estimate somewhere for figures of this description; but, of course, economy was out of the question. There was a plant in Kent working a 515 feet well, with the water 380 feet from the surface, and raising 4000 gallons per hour. A 15 brake horse power gas-engine was put in and found useless, then a 20, and last of all a 25, but the cylinder got too hot to run more than a few hours. Yet another plant was standing idle—rejected because, in a 400 feet well, the water could not be lowered below the 200 feet level. Why this was he could not explain; but he was forced to the conclusion that the pipe sizes employed were altogether wrong.

Mr. Percy Griffith (London) said this question had been a matter of study and interest to him for some time past; and he was not altogether without experience of it. But to give the details of this experience would hardly be as instructive as it was disappointing. The only case he had tried proved that the expectations held out by the contractors, and shared by himself, were totally falsified, and nothing like what was expected could be accomplished. All the inquiries he had made—and they were numerous—had pointed very much in the same direction. The plants that had been used in this country had been, in nearly every case, almost entirely experimental. He had not met anyone who was prepared to give him any definite guarantee as to what any particular plant would do; and here he referred not only to the question of duty (because he thought Mr. Maxwell had given them some figures which might be relied upon as to the average efficiency of this type of plant as compared with the ordinary plant), but he referred to the very intricate questions of the proper immersion and the proper proportion between the air-pipe and the water-pipe, and what was still more important, what might be expected to happen when these conditions were varied, and when the water-level fell to a very considerable extent. The whole matter was in a condition which attracted great interest, and particularly deserved more careful experiment than had yet been undertaken. Of course, to a large extent they looked to the contractors who made these plants; and he considered it might fairly be required of them that they should be in a position not only to guarantee in writing but to carry out their guarantees in practice. He thought they might fairly ask the contractors not to deal with this question as a mere matter of contract and finance, but to undertake something in the way of more complete experiments, so that they might know what they could guarantee, and not be led into giving promises which they could not fulfil, and which they could not compensate anybody for in failing to perform. There were some exceptions in this country; and he knew some of their friends were investigating the subject very thoroughly.

Mr. Joseph Price (Messrs. Le Grand and Sutcliff) said the members must all be very grateful to the author for the actual figures he had been good enough to place before them. The only figures from experiments made by experts and scientific men that he (the speaker) had been able to find were in a paper read by Professor Josse, of Charlottenburg; and they were very much confirmed by figures in a paper read before a Society in San Francisco. The other information that was available on the point had generally been qualified by a side-interest—frequently that of the compressor maker, because, in an air-lift plant, the compressor was the most expensive portion, and, if he might so put it, one of the most essential portions of the plant. There had been some criticism by one of the speakers of the quotation from Dr. Pohlé's specification. He himself had had reason lately to question the absolute correctness of the law laid down by the Doctor, which was his patent; and, he might incidentally say here, that he (Mr. Price) had been threatened with an action in connection with the air-lift pump by a holder of a Pohlé licence in Russia. Pohlé stated that the lifting of the water was done by what they would call the air-piston. Some experience of his own showed this sometimes to be the case. The more it was the case, the more unfortunate it was for the air-lift and the contractor who had to put it in; so that he was led now to incline to the small bubble aëration rather than to the large block air-piston. As to the ratios of lift to immersion, the members would understand that greater immersion meant higher pressure on the air, and there was what might be termed a critical point at which it became (although the air consumption might be less) a questionable economy to compress the air to a higher pressure, because, after all, the volume of air and its pressure were the real gauges of the efficiency and the working cost of the apparatus. Just lately, he had brought out what he considered to be some improvements in the air-lift. Though he could scarcely yet say they were beyond the experimental stage, they were of this interest—that he had been able to get figures which he did not see had been anticipated. There was a plant which he had been putting in, and which had been giving some little trouble, because it did not come up to the anticipated quantity. But on the question of economy for what it did, his figures worked out to $\frac{A \times B}{184}$ [see formula in paper] which was a decided gain, and practically verified his own calculations on the matter. He might explain here that the point of this improvement of his was this—that he had argued that, if they compressed air to a pressure of (say) 5 atmospheres, and utilized in an ordinary air-lift rising main, that air had to expand (as some of the makers of air-lifting plant said it did so expand), and by the time it got to the top it would occupy five times the volume. Pohlé and the American advocates laid down the dictum that high velocity was a *sine quâ non* of the working of the air-lift plant. Supposing they took Josse's figure of 300 feet per minute, if they were going to compress to five atmospheres, they would find, by the time it reached the surface it had to be five times 300, or 1500 feet a minute that the water had to travel to allow the air to expand. Every engineer who had to deal with the flow of water in pipes knew this was very difficult, and that the friction increased as the squares of the velocity. To meet this, he had arranged to allow the air liberty to expand laterally without materially increasing the velocity beyond the canons for the flow of fluids—in other words, to use a rising-main of increasing area. By this arrangement, he had got very much reduced figures from those which had been obtained so far, and which compared with the best examples he had been able to ascertain from the working of others. As to the ratio of lift to immersion, he had a case now in hand where he was putting in a plant for lifting 300 feet with an immersion of only 200 feet. This was quite the reverse of the law laid down. One gentleman had asked as to whether efficiency increased as the squares of the depth. Well the square of depth, he took as the square of the height of lift. It would be seen that, if a certain ratio of immersion to lift was absolute, then this meant also doubling the quantity of air to dilute the rising column. As to intercooling, he did not know whether the plant at Tunbridge Wells was simple or compound compressing. Of course, intercooling was absolutely necessary, and was the key of compound compression, on account of the heat that was generated in the initial compression. The second compression was able to take up the air at a lower temperature, but still under compression; and the total cost was materially affected by that. He was glad to hear that some of the members kept an open mind on this subject of air-lift pumping. Never for one moment would he think it was recommendable for places where there were large wells, and where ordinary high-class pumps and engines could be used. The system, however, had certain advantages; and if, instead of from two to three times the amount of power required per 1000 gallons lifted 100 feet high, it could be done, as he expected to do it, from 1¼ to 1½ times the power, then he thought there was much to recommend it. Although, taken week by week, the fuel cost might be slightly higher than they might have with a highly efficient pump, of the geared type suitable for borehole work, by the time the balance-sheet came to be made out at the end of the year—ignoring the side-issues of capital charges and labour (which so very much qualified the figures given by the author)—he thought air-lift pumping, under circumstances suitable for its adoption, would be such as he could consistently, as an engineer responsible for advising sound finance to his clients, heartily recommend, without having to run the risk of having to climb down from the position he had taken.

Mr. Rogers (who is associated with an American firm supplying this form of pumping plant) said the question of air-lift pumping in this country appeared to be in a very disturbed state. He had only found two plants over here, running under similar conditions, getting results that were in any way equal. Although he was interested in the pumping of water by compressed air, if it could be pumped more economically otherwise, he should say "pump it." The efficiency of the air-lift was not such as would recommend it while other methods of pumping could be more economically adopted. The greater part of his experience had been in the United States; and the question of coal consumption there had not the same effect as here—it was a quarter to half the cost of what it was here. They did not go in for high duties as here, nor did they expect them. Another thing was they did not go in for large boreholes. The largest found in the United States would be 8 to 10 inches; and, if the strata were rocky, the size was reduced. What they looked for was the greater quantity of water they could get out of the boreholes; and the air-lift was the means by which they got it. In the papers on the subject that had been presented before the different Societies in this country, the question had not, in his opinion, been tackled properly. The point as to the compressor had not been entered into to the extent that it should be. To his mind, it was a makeshift arrangement over here. He agreed that where a compressor was required for a pressure of over 75 lbs., the two-stage machines should be employed. They must look to the air-compressor for their results. They had to get a certain quantity out of it, and to get the air at the lowest temperature possible; and this could be better obtained now, at less cost, by the two-stage machines. Then they must also have a well that was suitable for the air-lift. The question of cost was a flexible one; the efficiency of the air-lift decreasing as the height of head increased. He denied, however, that the duty of the air-lift was now mere guesswork. [The speaker quoted a number of figures here, which were indistinctly heard.] Proceeding, he said that Mr. Maxwell had spoken of the loss of energy; but it was now true that a lot of the energy that had been lost could be collected and returned to the compressor.

It was being done to-day under very favourable circumstances; and the idea had been patented. From his experience, he could positively say the air-lift was not in an experimental stage. It had passed that, and certain results could be obtained, if the conditions were looked into. The question of compressor efficiency was one that would affect the result. In the majority of cases over here (Mr. Maxwell's patent was an exception), plants had been put down of the single-stage type; and these machines were not the most efficient.

Mr. T. W. A. HAYWARD (Stamford) said he had been interested in this question of compressed air, and had looked into it at one or two places in which it had been in operation. In one of the places, the plant was installed some fourteen years ago for raising water from a well; and he thought, in all probability, a mistake was made in putting down this system where it would have been much easier to have installed a deep-well pumping plant. He was pleased to hear Mr. Price say he should hesitate to recommend the putting down of this system where high-class engines and pumps could be installed. The makers had got these engines to work to such perfection that they could give them plant which would operate with the greatest efficiency at the lowest possible cost; and until the compressed-air machinery was out of the experimental stage, wherever they could use tried pumping machinery, they should do so.

Mr. WILLIAM WATTS (Sheffield) said one idea had occurred to him which seemed to be of considerable importance, and that was—what effect had atmospheric air forced into a borehole or well in keeping back the water which would necessarily flow into it? They all knew that water rushing into a borehole or well could be kept back if the pressure forced into it was greater than the hydrostatic pressure of the flow. He was rather afraid that where air-compressing plant was put down, that some effect in the way of a check of the inflow of water would take place.

[The author was not present to reply to the interesting and long discussion; but he intimated his intention of doing so in the Association's "Transactions."]

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Fiscal Question and Gas-Works Plant.

SIR,—My workmen and I have probably benefited largely by the eloquent witness of Mr. Hunt, in Parliament and in the Provinces, although I have had no personal relations with him during the many years he has given his services, with such brilliant success, to the gas industry. I cannot, therefore, pass over the reproof contained in his letter to the "JOURNAL" of this week.

It will be seen by my letter to my men (enclosed) that I am as much of a free-trader as your correspondent; but it must be free trade all round. The remedy will later on be before the country; and it is scarcely likely that a man who suffers keenly from the present system is going to stand tamely by while British industries are, under circumstances now in vogue, snuffed out one by one and ruined.

Mr. Hunt will probably agree that British manufacturers and British trading enterprise have contributed no little to the magnificent success which has attended gas administration; so I do not suppose he seriously means to suggest anything unkind to those who differ from him.

With all the difficulties and restriction upon the gas industry, it is a consolation to reflect that gas stock is at the top of the tree in the market of English industrial stocks—thanks not only to the able and wise direction of its administrators, but to the fact that the profession abounds with clever and highly trained engineers, among whom your correspondent holds so distinguished a place.

Whether this satisfactory state of things would continue when the British artizan is extinct, is worth consideration.

Exeter, Aug. 22, 1903. HENRY A. WILLEY.

[ENCLOSURE.]

An Open Letter, addressed to his men, by Mr. HENRY A. WILLEY, *on "Fiscal Reform; Wages and Work Defence."*

I have never allowed, nor shall I ever allow, any question of politics to enter into my relations with you; and the suggestion of my intending to coerce you is an insult to you and to me. It is a matter of supreme indifference to me whether a man is a Liberal or a Conservative; nor have I any concern with his religious convictions. His views on these matters are his birthright. The introduction of such questions is a curse in business, and leads to favouritism, preventing the best men from rising, and destroying mutual confidence.

The ambitions and aims of my life have been to help and benefit the working men, and more particularly those connected with me. As the business grew, I have invested a considerable part of my savings in providing machinery, &c., for the use of the workmen; and I need not go into the direction in which large sums of money have been spent for the benefit of the men, and, I hope, for the city generally. I have carried out some of the ideas which should make a straightforward workman's life a pleasure to him: Profit-sharing, manual education for boys, band, ambulance corps, a paper of your own where anyone may bring himself under my notice, the encouragement of invention, Friendly Societies, thrift, artizans' dwellings, workmen's gardens, trams, &c.; and I shall never be content until I double or treble the number of workmen, increase their wages, proclaim an eight-hour day, give them in time houses to live in of their own, and provide the aged and infirm with old-age pensions. I shall presently convert the business into a company, every man having an opportunity to share in it, and, following the lead of Sir George Livesey, probably appoint some of the men on the Board as workmen directors.

Now all this depends on the prosperous continuance of the business and on the manner in which you support me. To carry out successfully these schemes I must be surrounded by men in the chief positions in the place who loyally and whole-heartedly believe in their chief. There must be no divided counsels in our camp about anything that affects the existence of the business which supports us all.

Free Trade, as practised now, seriously injures this industry; and if it continues on the present lines, the number of men, at least in one department, will be reduced, for there will be no profitable work to do unless British markets are protected, or foreign markets opened to our manufactures. If the working classes of this country are content that everything shall be made abroad, they will be obliged to follow the work and clear out, too, or remain and starve.

I have spent large sums of money in obtaining foreign patents for meters and all kinds of apparatus; but the foreigner will not buy your work, and my view is that we can largely do without his. Shut out foreigners' goods from our markets; and they will soon come to terms and admit ours free.

I support any man, Chamberlain or anyone else, who will protect your living and mine, and don't care on what side of politics he is. But my men must take care lest in voting for or encouraging a Free Trade M.P. or candidate they do me—unintentionally, of course—and your industry here a great injury. I accept the responsibility that, in a large measure, both I and my works belong to my men. It is my firm intention never to forsake their interests as long as I live; and in any question so important as finding the work I do not believe they will throw their employer over for those who promise but can give them nothing. We have heard a great deal about "the open mind" and "the open eye;" but we have had "the open pocket" long enough.

I have said that I am a Free Trader. So I am; and so is everyone else who has any regard for the welfare of his country. But it should be free trade all round, as Cobden expected; and not till we compel the foreigners to open their markets to English goods and English work will justice and prosperity be assured to the British working man and the British nation.

In a crisis like this, I hope we shall stick to the bridge that carries us over.

Aug. 19, 1903. (Signed) HENRY A. WILLEY.

The Internal Combustion Engine as a Pumping Medium.

SIR,—In the discussion on this paper, I certainly implied that a consumption of 15 cubic feet of gas per brake horse power was a somewhat extreme case. It may be a fair average from the most up-to-date advertised lists; I was thinking of ordinary working conditions.

The purport of my remarks, however, was directed more particularly to the advisability of using a uniform unit when speaking about cost of pumping. We can understand what is meant when cost per brake horse power is mentioned; but to say that at "A" the cost is 3s. 3d. per 1000 gallons raised, at "B" it is 1·92d., and at "C" it is 1·23d., is of very little use or interest outside the particular pumping-station. It, at least, involves unnecessary calculation, if one would reduce it to a base for comparison with other consumptions. To take the pressure at the pumps, and reduce the cost to a unit of (say) a million foot-pounds (1000 gallons raised 100 feet) is such an easy matter that I feel sure the author will agree with me that the utility of his paper would be enhanced if he were to obtain this in the typical cases mentioned, and give it as a "note."

My remark, that the author "had not proved his case to any great advantage," had reference to the comparative cost of raising water by steam and internal combustion engines respectively. The average cost in such cases as he mentioned that could be reduced, was 0·92d. per unit (million foot-pounds).

The gas-engine working at 15 cubic feet, as stated in the paper, costs 0·45d. per brake horse power, and the oil engine mentioned costs 0·56d. A modern compound steam-engine will work at about one-half this.

Respecting the oil-engine I use for pumping purposes, it is one of the cheap-fuel type; and the oil costs 2½d. per gallon delivered. The cost of fuel in this case is 0·23d. per brake horse power or 0·18d. per pump-unit (1000 gallons raised 100 feet.)

HENRY PRESTON.

Grantham, Aug. 21, 1903.

Labour Representatives and the Royal Commission on Trade Union Law.—The organized workers of the country have resolved to "boycott" the Royal Commission on Trade Union Law; the following representatives, among others, having already refused to give evidence: Mr. W. B. Hornidge, President of the Trade Union Congress; Mr. Sam Woods, Secretary of the Parliamentary Committee of the Trade Union Congress; Mr. Isaac Mitchell, Secretary of the General Federation of Trade Unions; Mr. Will Thorne, the Labour candidate for South-West Ham, and the General Secretary of the National Union of Gas Workers and General Labourers; and Mr. Ben Tillett, Secretary of the Dock, Wharf, and Riverside General Workers. The workers assert that the Commission, from its very constitution, would be unable to take an unbiased view of the situation; and therefore they have refused to recognize it as a competent authority. The question is to be gone into at the Leicester Congress early next week.

Fires from Electricity in the United States.—The quarterly report, dated the 10th ult., issued by the Electrical Bureau of the National Board of Fire Underwriters (U.S.A.) shows that during the period covered by the report 28 fires were caused by the grounding of circuits, of which 13 were on awnings, metal work, and roofs of buildings, and 10 were on gas-pipes. Ten fires were caused by lightning, in four of which the current entered over wires, and in two cases over sprinkler pipes. Five fires were occasioned by over-heated rheostats, two of which were on electric cars. Three fires were due to over-heated pressing-irons. Reports of 128 electrical fires, entailing losses aggregating $471,700, were received during the quarter. The object of compiling and distributing these reports is not so much to ascertain the number and extent of the fire losses from electrical causes, as to demonstrate practically, by actual illustration, specific dangers that lie in a lax enforcement of the national electrical code of rules, and to bring about a greater unanimity of opinion regarding the problems presented by electricity considered as a fire hazard.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

Incandescent Burners and Electricity for Public Lighting—The South Metropolitan Company and the Monazite Sand Concession.

The Ordinary Half-Yearly Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. G. BRADSHAW in the chair.

The SECRETARY (Mr. H. D. Ellis) read the notice convening the meeting; and the report and accounts (of which the principal parts were published last week) were taken as read.

The CHAIRMAN, in moving their adoption, said: When we had the pleasure of meeting you six months ago, our proceedings were chiefly occupied with a discussion on the method of testing the Company's 14-candle gas prescribed by the Gas Referees; and you will recollect that I then explained to you that this method of testing imposed upon the Company the necessity of supplying gas of an illuminating power of 15 candles or over. You will also remember that you then authorized the Directors to promote a Bill in Parliament, providing that our gas should be tested in the same way as that of the South Metropolitan Gas Company. The Directors' report states that the Bill has become law. But I should explain that the Act, as passed, contains an important proviso—viz., that the Act shall cease to be operative after three years from now. The reason is this: The London County Council, of course, petitioned against the Bill; and they then approached the Board of Trade with a view to the appointment of a Departmental Committee to consider the whole question of the testing of the gas of the three Metropolitan Companies; and the Board of Trade practically agreed to do as they were requested. The Directors were thereupon pressed very much to withdraw the Bill; but this we steadfastly refused to do. On the other hand, we did not think it wise to refuse the compromise which was suggested at a conference of representatives of the London County Council and the three Gas Companies, held under the presidency of the Financial Secretary of the Board of Trade—that the Bill should be passed unopposed, with the addition of a proviso that it should only be operative for a period sufficiently long to allow of the issue of the report of the Departmental Committee. Subsequent events, I think, have proved that our action was right, because the fate of the Crystal Palace District Gas Bill in the House of Lords shows conclusively that we should not have had much chance of carrying our Bill in view of the appointment of the Departmental Committee; and we further gain this advantage, that the Committee will consider not only the question of testing the gas as regards its illuminating power, but also as regards the elimination of sulphur compounds, the tests for which have imposed a vexatious and absolutely useless burden upon the manufacture of gas in London for many years past. I must say the County Council took a reasonable course in dealing with our Bill; and I think, with some measure of confidence, there is ground for hope that, when the inquiry is held, they will approach the question with a statesmanlike desire not merely to harass the Companies, or to get the better of them, but to secure for the public what it is universally agreed is the demand of the time—that is, cheap gas suitable alike for heating, cooking, lighting, and engine purposes. Now, gentlemen, the other matters to which I wish to draw your attention very briefly you will find arise from the figures in the accounts. Our capital account shows for the first time the conversion of the stocks; and I think it also bears evidence of the cheaper money which is now at the disposal of the Engineer. You will see we have spent on capital account during the half year £41,770. This is a much larger sum than usual; but every penny of this expenditure will be productive of economy in working (which leads to greater profit), or has been employed in the extension of our business. Going to the items, the first is a small one of £325 for a little piece of ground at Wapping. As you know, we are glad to get anything there that we can to add to our works. The next item is a large one, £14,165 for steamers. Part of this has been expended on building a new steamer designed to run up the River Lea to the Poplar works, so as to save the cost of barging, and part in the purchase of the steamer which we have had under charter for many years past, and which is called the s.s. *Poplar*. The new steamer has been launched, and has been named the *Limehouse*. I hope, by the beginning of next month, she will be at work, and we shall then have two steamers running up the Lea to Poplar, capable of carrying not quite all, but nearly all the coal we use at the works, so that we have, as it were, succeeded in bringing these works down to the River Thames. The purchase of the s.s. *Poplar*, which was designed specially for our Wapping works to take the berth there, gives us one of the best little colliers on the Thames, and will lead to a considerable saving. In addition, we have chartered the *Ratcliff*, which is another of the steamers we have hired for years past, at a considerable reduction in price. So that altogether this half year we have made a very satisfactory saving in the cost of the carriage of our coal from the North to the works. The next item, £6995, for new and additional buildings, has chiefly been expended on the conversion of one of the retort-houses at Poplar, and in equipping it with regenerator furnaces and mechanical stokers; and we expect that this will eventually lead to considerable economy in working. The item also includes the provision of an additional crane at Wapping to accelerate the unloading of the ships. Then there has been an outlay of £12,370 for new and additional prepayment meters and fittings. We fixed no less than 3260 during the half year; and though they are being fixed as quickly as possible, the demand for them shows no sign of slackening. This is very satisfactory, because this is almost our only means of expanding our business. But, at the same time, the capital outlay is much greater than in the case of the ordinary consumer. A more remunerative item is that of £4647 for new and additional stoves, of which we fixed 1800 in the past six months. This large expenditure of capital leaves our capital account overdrawn by £37,248; and, as we have had to borrow nearly all the working capital from our bankers, the Directors felt the time had come to issue the balance of the debenture and ordinary stock created by the Act of 1875. It will be within your recollection that sometime ago you authorized the Directors to issue this stock as and when they thought fit; and therefore we decided that the best course to pursue would be to issue the ordinary stock to the consumers and employees in the manner provided by the Company's Act of 1902. This has been done with good results. It is, indeed, gratifying to be able to record that a large number of consumers and employees have come forward and asked for the stock; thus showing their confidence in the future of the Company, and their desire to further unite their interests with it. Now, if you turn to the revenue account, you will find everything that is satisfactory. The balance of profit is £66,332, which is larger by £9199 than it was this time last year. It is sufficient to pay the interest on the debenture stock, the interest on our floating loan, the stamp duty payable on the conversion of the capital, to give you the full statutory dividends (which we are paying for the first time for many years), and to leave besides a balance of £6476 to carry forward to the new half year. Adding this to the £10,034 brought forward from the previous half year, we have the substantial sum of £16,510 with which to begin the work of this half year. Now there is very little in the items of the revenue account to which I need call your attention, except to say that the improvement in the profit is nearly all due to receipts from the residuals. Coke produced £37,474, compared with £25,889 in the corresponding half of last year. That is an increase of £11,585. Breeze gave us £433 more; tar, £1819 more; and sulphate of ammonia, £1303 more. Altogether, we derived from this source £61,413, as against £46,269—in the first half of last year an increase of no less than £15,144. On the other hand, the receipts from the sale of gas are less by £7425; but you must bear in mind that the price charged for gas was 2s. 6d. per 1000 cubic feet, as compared with 2s. 8d. in the corresponding half year. The rental for meters and stoves amounts to £1667 more—so that altogether, with a few unimportant items, we have an improvement of £9199. Thus the Directors are enabled to recommend the payment of a dividend of £5 4s. per cent. on the 4 per cent. stock; and 5 per cent. on the 3½ per cent. stock. These rates of dividend are equivalent to 13 per cent. and 10 per cent. on the old and new stocks as they were before conversion took place. As I have said, this is the full statutory dividend; and it is the largest dividend you have had for the past six half years. We do not see any reason why you should not this half year have all you are entitled to under our Acts, because the consumers have been having their gas at a very reasonable price, and there are no special circumstances calling upon you to make any sacrifice such as you have so willingly and uncomplainingly done in the past. I am glad to be able to state that our consumers appear to be fully satisfied with the quality of the gas the Company are supplying under their new Act. The Engineer tells me he has not had a single complaint the whole half year; and I think the consumers ought to be satisfied, because the reduction in price has meant to them a saving of £11,567. Now turning to the reserve and insurance funds accounts, you will notice we have credited these funds with the interest on the investments which represent them. It is hoped to be able to continue this practice in future half years, so as to build up these funds to the level at which they formerly stood. I must say I think it is a great advantage both to the shareholders and the consumers that the price of gas and the dividends should be as free as possible from fluctuation; and this can only be done by keeping up the reserves so far as the Company's Acts allow. Altogether, our reserves amount to £75,778—that is, including the reserve proper, the insurance fund, and the sum carried forward, of which £36,708 is available for dividend. These figures compare very favourably with those of other companies; but, for the reason stated, I shall be very glad to see them increased as opportunity offers. Turning to the statement of gas made, sold, &c., it will be seen that we have sold 22½ million cubic feet more this half year than in the corresponding period of last year. This is equivalent to an increase of 1·6 per cent. The increase is wholly due to the coin meters; for, if it had not been for them, we should have had, instead of an increase, a small decrease. The 22½ millions represent in cash £2800, which, of course, is found in the profits. While on this account, I regret to say the sale of gas for public lighting is 2,800,000 cubic feet less. For this purpose, the consumption has been steadily going down for the last three or four years—ever since, in fact, the Borough Councils started their electric lighting schemes. I mention this, because I think we have now touched the bottom. We have long known that, for cheapness and illuminating power, incandescent gas can beat incandescent electricity out of the field; and this half year I think we have succeeded in persuading the Borough Councils that this is an actual fact. Some little time ago, we made them an offer to fit up all the public lamps that had not already been converted to incandescent gas or electricity with Kern burners, and at our own expense, charging exactly the same as at present until we had recouped ourselves for the initial outlay, and then to reduce the price. This offer we were able to make, because the incandescent burner consumes less gas than the flat-flame burner. Consequently, we shall be able to charge them less, and still get the profit we have had in the past. I am happy to say the offer has been accepted by the Borough Councils of Poplar, Stepney, and West Ham, in spite of the fact that they have electric lighting schemes of their own; and only the Borough Council of Bethnal Green (who have not an electric lighting scheme, but are about to start one), are hesitating, no doubt because they do not like to confess that gas can beat electricity both in point of price and efficiency. It is interesting to notice that Mr. Jameson, who is the able Engineer of the Stepney Borough Council, when he was advising them to accept our offer, is reported to have stated that the cost of incandescent electric lamps giving the same illuminating power as the incandescent gas-burners we are about to fix in the public lamps (he only took the illuminating power of the incandescent gas-lamps at six-tenths of what it actually is—that was to say, he cut down the illuminating power from 100 to 60 candles per lamp) was, notwithstanding this, about three times more. Mr. Jones and some of the officers of the Company say that the cost of electricity would be thirteen times that of gas; but however

that may be, I think it is very strong testimony in favour of incandescent gas lighting when an independent engineer of the eminence of Mr. Jameson says that electricity is so much more expensive. While on the subject of incandescent lighting, I want to make one remark. It is this—that I think the whole gas industry of the United Kingdom owes a deep debt of gratitude to our friend and colleague Sir George Livesey for the prompt and timely action he took with regard to the supply of thorium. Thorium, as you know, is one of the rare metals which burns with intense radiance; and it is essential in the manufacture of incandescent gas-mantles. Thorium is found in monazite sand, which can only be obtained in sufficient quantities from Brazil. Quite recently an attempt was made to obtain a concession of the monazite which would have given to the concessionaire a monopoly of the supply, and would have enabled him to charge the manufacturers of mantles practically any price he chose. This would have had the effect of bringing us back to the old ruinous state of things when the Welsbach mantles were so expensive. But Sir George Livesey—— [Sir GEORGE LIVESEY: Please say the South Metropolitan Board.] Very well, then, the South Metropolitan Board, by promptly sending out an expert representative to Brazil, succeeded in stopping the granting of the concession, and so saved the situation. I do not think their action has been sufficiently recognized; and I am glad to take this opportunity of acknowledging the debt of gratitude we all owe to them. There is only one thing more to say. The last paragraph but one of our report contains the news that Mr. H. E. Jones, our late Engineer, has been elected to a seat on the Board. I need hardly say that any gas company in any country in the world might well be glad and proud to have an Engineer of his eminence on their Board, but most of all the Commercial Gas Company, who owe so much of their prosperity to the ability and judgment with which he has conducted their affairs for so many years past. I congratulate his son that the first half year in which he has had sole control, has had such excellent results. The more we see of Mr. Stanley Jones's work, the more we like it, and the more we are convinced that, in appointing him as Engineer of the Company, we have the right man in the right place. Just one word with regard to the prospects of this half year. We have made a small saving in the buying of our coal, we are enjoying cheap oil, we have effected an economy in the carriage of our coal, we hope for economical working to ensue from the conversion of our retort-house at Poplar, and if the prices of residuals keep at what they have been during the past half year, I think in six months' time, we may hope to meet you with a report not much less satisfactory than the one we have the honour to present to you to-day.

Mr. T. BEVAN seconded the motion.

Mr. JOHN MEWS congratulated the Directors upon the excellent statement they had given to the meeting. He thought it showed great progress, if he might be allowed to say so, on behalf of the proprietors, because, in the first place, the capital question was not so crucial a matter as it was formerly. As to the items which the Chairman had read from the capital account, he saw that the amount expended for new and additional prepayment meters was three times the amount that it was in the corresponding half year; the item of stoves was not much less than three times; and with regard to new and additional meters and services, the item was considerably more than double. This all went to show that the Company were trying to do their best to keep pace with the times, and were showing that gas was an excellent illuminant. He also called attention to the item of the "amount invested, £62,778" in the balance-sheet, and asked whether this figure represented the investment of the reserve and insurance funds, and, if so, whether it would not be possible to allocate the sum in the accounts to the specific funds. One rather large item was "sundries, £30,396" while in the corresponding period it was only about £2000. There was no doubt some explanation of this of which he did not know. With regard to the employees' bonus and savings, they seemed to have got almost double what they had this time last year; but then, on the other side, there appeared some slight falling-off in the amount given to the profit-sharers. He did hope that the profit-sharing would now be successful. It was no doubt a great thing for the working man. Many working men had told him that it was perfectly impossible for them to save if they were not given a chance to do so; and such a system as this, it was his firm opinion, conferred benefit not only on the men, but the Company and the country. The question of thorium was a very important one; and he was glad it had been raised, because it seemed to him it would put plenty of people on the *qui vive*, and they would now try to find out whether there was not some other source of monazite sand which would give a sufficient percentage of thorium to make it worth while putting it to commercial use.

Mr. SIMPSON ROSTRON said, as to the remarks of the Chairman on the subject of the "abandonment of electric lighting by local authorities," he might say, to show how this kind of thing was spreading, that only the previous afternoon he happened to be coming from the offices of a certain Company on the other side of the river when, coming to Jamaica Road or St. James's Road, he saw some electric light columns, and, going on a little farther, he found columns of the same sort on which there were fixed incandescent gas-burners.

The CHAIRMAN, in reply, said the £62,778, the sum shown in the balance-sheet as invested, represented the full amount of the insurance fund and nearly all the reserve fund. The rest comprised fractions of stock which they had to take in the conversion of the capital, and some of the deposits which they invested. The reserve fund was now fully invested. As to the item of sundries, this contained a large sum that was due for the debenture stock. It was issued at the very end of June; and the cash was not payable until the beginning of July. But the Directors thought it right to insert it in the accounts, because the stock had actually been allotted, but the money had not been paid. As to the profit-sharing, Mr. Mews had drawn attention to the fact that the sum charged was less than at this time last year. Then they included the charge for twelve months; while the amount charged in the present accounts was only for six months. At Christmas last £1700 was charged, so as to equalize the burden over the twelve months. Respecting Mr. Rostron's remarks, he (the Chairman) did not mean to say that the Company had sufficiently enlightened the Borough Councils to get them to root up existing electric lighting. What they had done was to convince them sufficiently to get them to agree to continue the gas where it was at present, but in a better form.

The dividend proposed (as mentioned in the Chairman's speech) having been declared,

Mr. ENNIS moved a vote of thanks to the Chairman and Directors. In doing so, he expressed the opinion that the reserve fund was inadequate for the responsibilities of a great Company like this. The Chairman had mentioned the fund with a view to its enlargement; and he (Mr. Ennis) hoped the Board would bear this strongly in mind. Now that they were entering upon better times, they should certainly consider the necessity and expediency of increasing the fund.

Sir GEORGE LIVESEY: You must give up dividend to do it.

Mr. ENNIS replied that he was not opposed to that, in a measure.

Mr. BADDELAY seconded the motion, and observed that there was no part of the report with which the proprietors were more pleased than that which announced that the Directors had, very wisely, elected Mr. H. E. Jones to a seat on the Board.

The resolution was heartily agreed to.

The CHAIRMAN, having responded, moved that similar recognition be made of the services of the officers (particularly mentioning Mr. H. D. Ellis and Mr. Stanley H. Jones, the Engineer), their respective staffs, and the employees generally. He stated that the work of the Company had never been better done, nor the interests of the proprietors more closely looked after, than at the present.

Mr. BEVAN seconded the motion, which was unanimously passed.

Mr. ELLIS, having acknowledged the vote, called attention to two recent legal decisions of interest to gas companies. The first decision was one which extended the operation of the Workmen's Compensation Act, so that a man who exerted himself to the utmost in a company's service, and in so doing injured himself, would, even if the "fortuitous element" was eliminated, be entitled to compensation.* There were some, he remarked, who thought this would not operate fairly to a company. He (Mr. Ellis) did not share this view, believing that they would get the best service from a man who knew that, in exerting himself well, he would be covered any risk or any loss or damage he might sustain in doing his best for the company he served. The other legal decision was one of serious moment to all shareholders in all undertakings in this country. He alluded to the judgment of Lords Justices Vaughan Williams, Romer, and Stirling, in the Court of Appeal, in the case of the *Corporation of Sheffield v. Barclay and Co.* [This case was reported in the "JOURNAL" last week; and it had reference to the question of liability for forged transfers.] The defendants were held liable by the Lord Chief Justice; but the Court of Appeal allowed their appeal. This decision, said Mr. Ellis, had fallen like "a bolt from the blue." But, said he, "thank God we have a House of Lords" to which this case would be carried; and therefore there was no need to cry out yet. If, however, the judgment should unhappily be confirmed by the House of Lords, it would be incumbent upon the directors of all undertakings to consider, in concert or otherwise, what steps they would have to take to promote legislation, if necessary, to protect their shareholders from this new element of danger, over which they had no control. He should most carefully watch the progress of events, and keep the Board fully informed of what was going on in this matter. But he hoped the judgment of the House of Lords would have the effect of restoring them to what the law was a month ago.

Mr. STANLEY JONES also expressed his great appreciation of the kind things that had been said about himself, the engineering staff, and the workmen.

This concluded the proceedings.

LIVERPOOL UNITED GASLIGHT COMPANY.

Corporation Electric Light Competition.

The Half-Yearly Meeting of this Company was held at the Offices, Liverpool, last Tuesday—Sir EDWARD LAWRENCE, the Chairman, presiding.

The CHAIRMAN, in moving the adoption of the report, said he thought the Directors had not been wanting in their duty either to the shareholders or to the public; for they recognized they had a duty to both. The past year had been uneventful generally; but there was this peculiarity about it—that they had an increase in the quantity of gas consumed up to a certain point, and then, about the month of February, owing to the extraordinarily mild weather, the whole of the increase seemed to disappear. He was glad to say that before the end of the half year it recovered a little, and that they closed the year with a slight increase, and not a decrease, as had been the case with very many gas companies. This showed there was no diminution in the demand for gas. Twelve months ago, the price was reduced 3d. per 1000 cubic feet; but the result did not realize expectations, owing to the unusual climatic conditions to which he had referred. Still, during the year they sold 3,595,905,000 cubic feet of gas, compared with 3,578,904,000 cubic feet in the year previous—an increase of 0·47, or nearly ½ per cent. The receipts from gas during the year were £38,211 less than in the preceding year, owing to the reduction in the price; but this almost exactly corresponded with the saving effected in the cost of coal and other manufacturing materials. As a result of the year's operations, there was a sum transferred to profit and loss of £111,716. After deducting the dividend declared last February, and the interest on debenture stock, there remained a balance of £58,302, from which had to be deducted the dividends for the last half year, leaving them still about £5000 to the good. While they did not make enough in the twelve months to pay the statutory dividends, they knew they started the year with a balance in hand of £13,000, which justified them at the time in reducing the price of gas. They had had to take out of the balance about £8000; but they had still £5000 left. He was glad to state that the estimates which had been put before them for the coming year showed that, at the present price charged to consumers, they

* This was the case referred to in the "JOURNAL" for Aug. 11, p. 352.

would do more than cover their expenses during the next twelve months. He would have been pleased had it been possible to further reduce the price; but there was no possibility of this at the present moment, and he hoped the public would be satisfied that the Directors had done all they could to serve their interests. Many people thought the Gas Company was a monopoly, and that they did not care a fig about the price of gas beyond paying their statutory dividends. There was no greater mistake ever made, although no doubt some critics in the newspapers would say: "Oh, the Chairman of the Company is sure to say that on behalf of his Company." Nevertheless, the truth was it had been their anxious desire at all times to keep the price of gas down as low as it could possibly be kept. The answer of the critics to that was that a public company with a monopoly had no inducement in this direction. Supposing, for the sake of argument, that this was correct, what was the position of things at the present day? They were no longer a monopoly—if ever they were; they were met with the keenest possible competition. The Liverpool Corporation had undertaken the production of electric light, and the supply of it to the public instead of gas; and they would do their utmost to promote the sale of their own illuminant to the detriment of gas. Therefore, the competition was as great as if the Corporation had gas-works under their own control; and the Company were bound by every interest to do all in their power to produce gas at the lowest possible price. He wanted the public to understand the altered condition of things. Apart from the past, they had every inducement to cheapen the price of gas. They wanted to keep the consumption to such a point as would make the production of gas a profitable business; and this could only be done by making the price as low as possible. He did not think they had ever been open to the charges which had been brought against them; but the shareholders might depend upon it they would take care to do all they could to render their recurrence impossible. The public should also remember that their hands were more or less tied, and that they could not enter into competition as freely as they might otherwise do with those who were now engaged in business against them. They were tied by Acts of Parliament, which limited them entirely to the quality of gas they were bound to produce, and also fettered them with arrangements in other ways. They could not get rid of these restrictions without going to Parliament.

Mr. GALLOWAY: Have you ever tried to get the illuminating power reduced?

The CHAIRMAN: No; we have not done that. Whether it is to be done in the future or not is another matter. At all events, it cannot be done without going to Parliament, which is a costly operation at all times; and I do not think we should be acting either in the interests of the shareholders or of the public by attempting to go to Parliament at present.

Mr. GALLOWAY: Perhaps you might come to an arrangement with the Corporation? If the illuminating power were reduced, it would make a wonderful difference.

The CHAIRMAN: We have not found the Corporation at all times ready to make arrangements with us. If the Corporation would say: We will support you in going to Parliament, then we might have a fair hope that our expenditure would not be serious. But if we had to go to Parliament and fight the Corporation, the expenditure would be very heavy indeed.

Mr. GALLOWAY: I do not suggest that.

The CHAIRMAN, in conclusion, assured the shareholders that their property was well looked after. He hoped they would always be able to feel that their interests were carefully guarded, while the Directors did not neglect the duties they owed to the public.

Mr. J. E. TINNE, the Deputy-Chairman, seconded the resolution, which was adopted; and the statutory dividends of 5 per cent. on the ordinary consolidated "A" stock, and 3½ per cent. on the 7 per cent. "B" stock for the half year ending June 30 were declared.

Sir Wm. B. Forwood, Messrs. A. Fletcher, J. Lister, and T. Case Morris were re-elected Directors; and Mr. Burton W. Eills was again appointed Auditor.

On the motion of Mr. G. OKELL, seconded by Mr. GALLOWAY, thanks were accorded the Chairman and his co-Directors for their services during the year.

TOTTENHAM AND EDMONTON GAS COMPANY.

A Large Increase—New Proposals—Reduction in Price.

The Ordinary General Meeting of this Company was held last Saturday, at the Offices, No. 639, High Road, Tottenham—Mr. CORBET WOODALL in the chair.

The SECRETARY (Mr. James Randall) having read the notice calling the meeting, the Directors' report and accounts, to which reference was made in the "JOURNAL" last week, were taken as read.

The CHAIRMAN said the report, though short, was, he thought it would be agreed, satisfactory. The past half year had not been one that had been found generally helpful to the consumption of gas. Owing to the mildness of the winter season, there had been a general falling off in the rate of increase which companies had experienced; but in their own case, they had had an increase of nearly 17 per cent.—a rate which, he need hardly remind the proprietors, meant, if continued, a doubling of the output of gas in four years. They had had a considerable increase in the number of their consumers. Their ordinary meters showed an increase in the past three years of 9, 10, and 12 per cent. respectively; and the coin meters had increased by 8, 16, and 30 per cent. in the respective years. Ordinary stoves showed an increase of 11 per cent. compared with a year ago; and stoves under the prepayment system 13 per cent. The additional public lamps equalled 8 per cent. These increases disclosed a very healthy state of affairs; and the Directors saw no reason whatever why the progress should not be continued at an equally satisfactory rate in the future. They had in their area something like 500 gas-engines at work, varying in power from ½ horse up to 100 horse. These were concentrated largely in a comparatively small area, and within a short distance of the gas-works. Application had been made to the Directors more than once to furnish a supply of cheaper gas for the purpose of working these engines; and the Directors had had under consideration this very important question. If the demand was of such a nature as to justify this special manufacture, the Directors, on their part, would have no objection to engaging in it. One thing they would have to be clearly satisfied about was that, while furnishing a supply of gas at a rate per 1000 cubic feet cheaper than the ordinary supply, it was really cheaper to the user having regard to the suitability of the gas for the purpose intended. It would be a mistake to judge of the gas supply by the measure of so many cubic feet, without taking into consideration what those cubic feet contained. Now as to the accounts, the improved balance shown on the account was due particularly to two factors: First of all, there had been a saving of 1½d. per 1000 cubic feet in the net cost of coal; and, secondly, there had been, upon the cost of manufacture and distribution, a saving of about 1d. They had spent rather less upon repairs of works, but had expended some £2500 more upon the repairs, renewals, and up-keep of the distributing plant generally. The unaccounted-for gas was slightly less than last year; being 6·4 per cent. And another satisfactory item to which he might call attention was that the cost of dividend and interest was less by 0·6d. per 1000 cubic feet than it was this time last year. The Directors and the Engineer had had under consideration for fully three years the question of a large extension of the gas-works. He had already said that, at the rate at which the consumption was increasing now, four years would see a doubling of the output of gas. It needed no enforcing upon the proprietors that this meant a large expenditure on new works; and these they would have to take in hand next year. The period to which he had been referring had been one of peculiar activity among gas engineers and others in the direction of improvements in plant and apparatus connected with gas-works. This being so, the Directors had preferred to postpone as long as they could this large expenditure on new works, in order that they might have the advantage of watching the developments that were taking place. He might mention incidentally that gas-retorts were in a state of instability. As some of the proprietors knew, a few years ago the retorts were elevated from the horizontal; and now there seemed at least the probability that this alteration might be carried farther, and the retorts assume a vertical position. If this was not realized, they had the choice of some vastly improved methods of mechanical stoking, which would lead to a reduction in the labour, and at the same time an economy in the cost of that important part of the work of gas production. These were matters of so much interest to the Directors and the Engineer, that last year they merely erected an addition—but a very valuable addition—to their retort-house, which would be sufficient to carry them over this year, and through the winter of 1904. Therefore it would be imperative next year to take this important matter of new works in hand. Turning from the works to the domestic side of the business, he was glad to say they had maintained a thoroughly satisfactory supply of gas, which had completely satisfied their consumers. The cheapening of the incandescent mantle was welcomed by them, in common with all suppliers of gas, as a very great help. While reducing the amount of gas used, the incandescent mantle had the effect of so far improving the character of the supply that there was less probability than there had been in the past of the consumers wishing to make a change. Its general introduction placed gas so far and away in advance of every other light from the point of view of economy, that practically competition was impossible on that head. More attention was also now being given to improved means of, and conveniences in, lighting and extinguishing gas-burners, in which connection he might incidentally mention a very pretty system which he had had installed in his own house, whereby, by pressing a button, the incandescent gas-burners in a room were ignited, and by another press were extinguished. It was in such conveniences as this that the electric light had so great a charm for many people; and therefore developments of this sort gas people should welcome and do their best to encourage. In connection also with the character of the fittings that were used with gas, their electrical rivals had had a lead in comparison, which lead there was no reason they should hold. However, on all grounds, the Directors were satisfied that the position of the gas industry was a sound and stable one, and not less so in Tottenham than elsewhere; and he (the Chairman) was quite sure it had before it a very prosperous future. He had said that they were now beyond the reach of competition upon the mere question of price. At the same time, the proprietors knew quite well the policy of the Company had been throughout—at any rate, during the time that he had had the opportunity of knowing it—to supply gas as cheaply as possible; and it was, therefore, with extreme pleasure that they announced their intention of reducing the price of gas by 2d. per 1000 cubic feet at the end of the current half year. The average price then would be just about 2s. 8d. per 1000 cubic feet, which was encouraging to the Directors, having regard to the circumstances in which they were placed, and the cost at which they were getting materials. With this satisfactory announcement, he formally moved the adoption of the report and accounts.

Mr. JAMES WARREN seconded the motion, which was unanimously carried.

Proposed by Mr. HENRY BAILEY, and seconded by Mr. D. FIGG, dividends were declared (less income-tax) at the rates of 6 per cent. on the "A" consolidated stock and 4½ per cent. on the "B" and "B" additional stocks.

Moved by the CHAIRMAN, and seconded by Mr. J. L. CHAPMAN, Mr. D. Ford Goddard, M.P., was re-elected to his seat at the Board; and afterwards, on the motion of Mr. GERALD T. WATSON, seconded by Mr. A. W. OKE, the Chairman was also returned.

The retiring Auditor (Mr. E. Crowne) was next re-appointed, on the proposition of Mr. JOHN RANDALL, seconded by Dr. SCOTT.

Mr. H. D. ELLIS, in moving a vote of thanks to the Chairman and Directors and the Secretary (Mr. J. Randall) and Engineer (Mr. A. E. Broadberry) for their able conduct of the Company during the half year, said he envied the feelings of the Chairman at the time he put his signature to the accounts. They were something perfectly astonishing to him (Mr. Ellis). He had been accustomed to looking to the Company making a substantial percentage increase during a half year; but knowing, from daily observation of gas affairs in the Metropolis, what

a slender chance many companies had had of making any increase at all in the last six months, he was perfectly staggered when he learned that this Company had had an increase of 16·79 per cent. It showed the concern was making giant strides in progress; and he supposed that there was no finality in it, and that they might hope for the same thing in the future. The Chairman had treated of one or two matters upon which he would also like to remark. One point had reference to certain fittings used in connection with gas, and the other had relation to their old rival electricity. The Chairman had adverted to an electrical igniting and extinguishing arrangement and other inventions. No doubt these were very valuable helps in the use of gas; but he fancied that consumers wanted teaching the use of these things. Many of these new conveniences and improvements consumers never heard of at all; and, when they did hear of them, they straightway forgot all about them. What was wanted was that they should be brought prominently to their notice, and then their usefulness demonstrated to them in the show-rooms of gas undertakings. As to the second point, he stated that gas suppliers had nothing to fear from the competition of electricity. Price for price, gas could beat it out of the field. In the public Press, they could read—especially if they read the "St. James's Gazette"—that electricity was very much cheaper than gas. This, of course, was all nonsense, as he proceeded to show by referring to the independent testimony that the Commercial Gas Company had had during the past half year (as mentioned by Mr. Bradshaw at the meeting of that Company) in connection with their offer to convert the street gas-lamps to the incandescent system. This testimony was to the effect that, in the case of one Borough Council, there was a strong party in favour of electricity. The matter was referred to the Borough Engineer (who is an able and impartial gentleman, and the Company had no reason to believe him to be a friend of theirs); and he reported that the cost of lighting the streets by incandescent gas-burners would be one-third of what the Council were paying for electricity.

Mr. W. T. Baker seconded the motion, which was very cordially agreed to.

The Chairman, in responding, said he entirely agreed with Mr. Ellis that consumers did not know very often how best to use gas. He had heard it said that it was not in the interests of gas companies to encourage the development of burners and so forth that tended to reduce the quantity of gas consumed. A more mistaken idea could not possibly be ascribed to an intelligent gas company. The Chairman described what the Company were now doing in this respect, and would continue to do, to remove the reproach which, he said, did lay upon the use of gas, and which gas companies must take a full share of responsibility for, because, in the past, they had not done what they might have done in the direction of educating the consumers. As to their officials, the Directors recognized the great obligation the Company were under to them. Mr. Randall was everything they could wish; and, in their Engineer, they had a man whose future he (the Chairman) was sure would justify the confidence the Board had always felt and expressed in him.

There was also a vote of thanks passed to the Auditors; and Mr. Chapman, in his reply, made the interesting announcement that, in the past quarter, his own Company (the Harrow) had experienced an increase which came close upon the percentage increase of the Tottenham Company for the half year. The increase in the sales at Harrow in the quarter was 14·16 per cent.; and the Company were going to pay the full statutory dividends for the first time.

This concluded the proceedings.

CROYDON COMMERCIAL GAS COMPANY.

Half-Yearly Report and Accounts.

The following report of the Directors of the above-named Company will be presented at the 113th half-yearly meeting on Friday.

The receipts from the sale of gas show a decrease of £1908 2s. 7d., compared with the corresponding period of last year. This is due to the fact that during the Lady Day quarter this year the price of gas was 2d. per 1000 cubic feet less than in that quarter of 1902. The receipts from all residuals are, however, satisfactory, from the points of view both of quantities produced and of prices realized. A saving has been effected in manufacturing expenses as compared with the corresponding period of last year—a result which is attributable chiefly to the operation of the new machinery and other plant installed during the last twelve months. A general exhibition of gas appliances, &c., on a somewhat extensive scale was held by the Company at the Public Halls, Croydon, from April 27 to May 2. This exhibition was largely attended by the public; and the Directors believe the results will prove beneficial to the Company. The number of consumers and of stoves on hire has during the past year grown as follows:—

Ordinary consumers from	10,828	to	11,544; an increase of		716
Prepayment ,, ,,	7,478	,,	8,651	,, ,,	1173
Total . . .	18,306	,,	20,195	,, ,,	1889
Heating stoves on hire from	1,447	,,	1,647	,, ,,	200
Cooking ,, ,, ,,	8,234	,,	9,312	,, ,,	1078
Total stoves . .	9,681	,,	10,959	,, ,,	1278

After providing for all fixed charges, carrying £1500 to the reserve fund, and writing off £1000 in respect of the old Carshalton works, the sum available for division is £18,083 16s. The Directors recommend that, in lieu of paying dividends free of income-tax, as on previous occasions, the following dividends be declared for the half year: At the rates of 14½ per cent. per annum on £51,600 of "A" stock, 11½ per cent. per annum on £178,400 of "B" stock, and 9½ per cent. per annum on £70,000 of "C" stock—all less income-tax. These dividends will absorb £17,324, and leave a balance of £759 16s. to be carried forward.

The accounts accompanying the report show that £10,437 was expended for capital purposes in the six months ending June 30; £4369 being for new buildings and plant, £3547 for new mains and service-pipes, and £1219 for new stoves. The total capital outlay on the works up to date is £457,422, while the amount of capital called up is £440,953; leaving a debit balance of £16,469. The revenue from the sale of gas amounted to £59,192; from meter, stove, and fittings rental, to £5159; and from residuals, to £17,699—the total receipts being £82,130, against £80,980 in the first half of 1902. The manufacture of gas cost £43,796 (coals figuring for £28,935, compared with £29,617); distribution entailed an expenditure of £9314; management came to £2693; and the total expenses were £62,196. The balance carried to the net revenue account is £19,934, whereas this time last year it was a little more—£20,226.

In all, 28,161 tons of coal, 2 tons of cannal, and 445,945 gallons of oil were used in the production of 456,446,000 cubic feet of gas, of which 424,739,900 cubic feet were sold and 431,392,200 cubic feet accounted for. The estimated quantities of residuals produced in the half year were: Coke, 16,898 tons; breeze, 5444 tons; tar, 371,895 gallons; ammoniacal liquor, 861,198 gallons—the quantity of sulphate of ammonia made being 329 tons.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Extended Sphere of Operations at Maidstone.

On the whole, the account which the Chairman of the Maidstone Gas Company (Mr. G. Marsham) had to present to the shareholders, at their recent annual meeting, on the progress of the undertaking, was fairly satisfactory. There was a balance of £12,017 in favour of the Company; and the Directors recommended the declaration of a dividend for the year ending June 30 at the rate of 10¾ per cent. per annum, less income-tax. The reduction made in the price of gas brought down the income to a certain extent; and what would have been a compensating feature of the accounts—a decline of £500 in the cost of distribution—was nullified by a rise of £300 in the rates. However, the total expenditure was £500 less than in the year 1901-2, which was due chiefly to the satisfactory agreement the Directors had come to with regard to the cost of coal. Further, the meter-rentals showed an increase of £300. The Company obtained an Act last session enabling them to consolidate and increase their capital and extend their limits of supply. They were unsuccessful in obtaining a reduction in illuminating power to the extent desired—viz., from 15 to 13 candles; but the House of Lords gave them 1 candle. The standard prices are now 3s. 7d. and 4s. 4d. (according to distance) per 1000 cubic feet. The mains are being extended to the added districts; and, so far as Aylesford is concerned, orders are coming in faster than they can be executed. Of course, reference had to be made to the unfortunate gas explosion, which cost the Company £2398, which the Directors decided to charge to the profit and loss account. However, this trouble has not led to bad feeling between the Company and the local Board. The dividend was declared. At a special meeting held at the close of the ordinary business, the Directors were authorized to raise additional capital by the issue of stock and on mortgage bonds or debentures.

Prepayment Meters Increase Business at Scarborough.

At the half-yearly general meeting of the Scarborough Gas Company on the 15th inst., the report presented showed the amount of net revenue for the six months ending the 30th of June to be £7604; and out of it the Directors recommended the payment of the usual dividends (less income-tax) on the ordinary stocks. These would require £6588, and leave a surplus of £1016 to be carried to the reserve account. The Chairman (Mr. B. Fowler), in moving the adoption of the report, congratulated the shareholders on the excellent position of the Company. He said the quantity of gas sold during the six months was 127,814,400 cubic feet; being an increase of 2·53 per cent. on the sale during the corresponding period of 1902. Three-fourths of this increase was owing to the extended use of prepayment meters, a large number of these having been fixed during the past few years. The extra revenue from the sale of gas amounted to £471. They had also done better with the residuals to the extent of £372. Altogether, the increased income amounted to the satisfactory sum of £1008. On the expenditure side of the account, there had been savings as compared with the first half of 1902; the principal being for coal and oil, which cost £886 less. The amount placed to the reserve account would bring it up to £14,485 The dividends recommended were declared. In acknowledging the usual compliment to the Directors, the Chairman moved a vote of thanks to the Manager and Secretary (Mr. Alexander Allan) and the staff, whom he complimented on their efficient services.

Shareholders and Consumers Benefit at Taunton.

The salient feature at the annual meeting of the Taunton Gas Company last Tuesday was the announcement of the continued increase in the business, as shown by additional sales to the extent of 2,414,800 cubic feet, bringing up the quantity to 81,211,800 cubic feet. The Chairman (Mr. J. Barrett) remarked, in moving the adoption of the Directors' report, recommending the declaration of dividends of 5, 7, and 8 per cent. on the several classes of shares, that it was a very good increase, and showed well the sustained prosperity of the Company. The Deputy-Chairman (Mr. Barnicott) referred to an interesting feature of the report, from the consumers' point of view, in the shape of an announcement of a reduction of 3d. per 1000 cubic feet in the price of gas. He called attention to this as evidence that the concern in which they were interested was a consumers' as well as a shareholders' Company. When they started business, the former Company had been charging 12s. 6d. per 1000 cubic feet, though coal was very much cheaper then than now. He was glad to know that their Manager and Secretary (Mr. A. Edwards) shared the same view—that the interest of the consumers was the most important thing to keep before them. It was not to the benefit of the Company that their customers should

burn gas wastefully or extravagantly; and he hoped next year they would be able to carry out a further scheme of improved public lighting without any extra expense. The report was adopted; and the dividends recommended were declared. A vote of thanks was passed to Mr. Edwards and his staff for their services; the Chairman remarking that when Mr. Edwards was appointed 27 years ago, the output of gas was 34 million cubic feet, whereas now it was more than 81 millions. The dividends at that time were 6 per cent.; now they had gone up to 8 per cent. The thanks to the Manager and his staff were richly deserved. Mr. Edwards, in reply, said there never was a time in the history of the Company when there was less difficulty and trouble than at present.

Reduced Price Pays at Wakefield.

In presenting the report and accounts to the shareholders of the Wakefield Gas Company on Monday last week, the Chairman (Dr. Statter, J P.) stated that this time last year he had the pleasure of congratulating them on the fact that the balance-sheet put before them broke all previous records, and was the best the Company had ever submitted. On the present occasion he had a similar agreeable duty to perform, as the balance-sheet was considerably better than that of last year, and again broke the record, though they had reduced the price of gas 3d. per 1000 cubic feet on the 1st of April. This brought down the gas-rental for the June half year by £586; but it was still £15 more than before, which was very gratifying to the Directors, and showed that the policy of reducing the price when practicable was a paying one. They had sold 4½ million cubic feet more gas during the six months—an increase at the rate of 3½ per cent. The profit made enabled them to write another £2000 off the suspense account, reducing it to £2500, pay the usual dividends, and carry forward to the credit of the profit and loss account more than they did last year, though they had spent £508 more on the maintenance of works and plant. The reduction of 3d. had enabled the Directors to induce the Lighting Committee of the Corporation to agree to the conversion of a large number of the lamps in the city to the incandescent system, and so retain this business, which might otherwise have been lost. The report was adopted, and dividends at the rates of 11½, 9, and 8½ per cent. per annum were declared. In acknowledging a cordial vote of thanks to the Directors for their successful efforts during the past half year, the Chairman moved the customary vote of thanks to the officers in very eulogistic terms. This was acknowledged by the Engineer (Mr. H. Townsend) and the Secretary (Mr. W. H. Parker), who both spoke highly of the efforts of their respective staffs.

Extended Works, Increased Business, and Reduced Price at Weymouth.

The net profit realized by the Weymouth Consumers' Gas Company in the six months ending the 30th of June was £2561; and after payment of the debenture interest, the Directors were in a position to recommend, at the half-yearly meeting on Thursday, a dividend on the ordinary stock at the rate of 5 per cent. per annum. The report in which this fact was made known to the shareholders contained the pleasing announcement, from the consumers' point of view, of a reduction of 2d. per 1000 cubic feet in the price of gas (bringing it down to 3s. 6d.) on the 1st of October. The Chairman (Mr. J. E. Robens), in moving the adoption of the report, stated that this concession would have been made years before, had it not been for the heavy expenses the Company had had to meet. These began when the necessity arose for obtaining a new Act of Parliament, because they could not proceed with the extension of their works until they had obtained authority to raise the money. That necessity, however, was a very happy one so far as the Company were concerned. It had arisen from an increasing consumption of gas, and from their having outrun the power to supply it. (The gas sold in the last half year was 8·8 per cent. more than in the first half of 1902.) During the last six years they had been continually endeavouring to meet the increased demand. Now they had a new and complete retort-house, and, as a result, were getting very much larger returns than before. Contrasting the present position of the Company with the early days of the undertaking, he reminded the shareholders that when they took over the old concern, gas was 5s. 6d. per 1000 cubic feet, and only of 10-candle illuminating power. Now the price would shortly be reduced to 3s. 6d., with an illuminating power of 15-candles, which could be easily raised to 45 candles by the use of incandescent burners. When they took the works over, the Company were in such a position that they could not get the capital necessary for carrying on the business, unless the Directors became personal guarantors for the £15,000 which had to be raised, and for which they had to pay 5 per cent. During the last year or two, when they wanted to raise £18,500, they obtained it at 3½ per cent.; and there were inquiries for more money than was needed; thus showing the position the Company were in. This £18,500 had only added £147 10s. a year to the annual charge on the revenue. Just at the time when the necessity arose for raising that money, the debenture stock fell in, for which they were paying 5 per cent., and they obtained their loan at 3½ per cent.; so that they were about £150 better off. The Company's works were practically complete. He congratulated Mr. Lowe upon his able management, saying they were all proud of him. The dividend having been declared, the Chairman, in responding to a vote of thanks to himself and his colleagues, proposed a similar vote to the Manager and Secretary (Mr. Lowe) and his efficient staff, which was carried by acclamation, and duly acknowledged.

Water.

An Obstructive Local Authority.

The Chairman of the Frimley and Farnborough District Water Company (Mr. A. C. Pain, J.P.), at their recent half-yearly general meeting, had a very good account to present to the shareholders of the progress of the undertaking in the six months ending the 30th of June, seeing that the profits were sufficient to enable the Directors to pay a dividend of 6 per cent. per annum, though they only recommended

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 498.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
390,000	10	April 17	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	May 14	6½	Bombay, Ltd.	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Aug. 13	12	Brentford Consolidated	235—240*	..	5 0 0
300,030	,,	,,	9	Do. New	173—178*	..	5 1 1
50,000	,,	,,	5	Do. 5 p.c. Pref.	150—135*	..	3 14 1
206,250	,,	June 11	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
220,000	Stk.	Mar. 12	10⅝	Brighton & Hove Orig.	212—217	..	4 19 1
246,320	,,	,,	7⅜	Do. A. Ord. Stk.	151—156	..	4 19 4
460,000	20	Mar. 31	10	British	39½—40½	..	4 18 9
100,000	Stk.	Aug. 13	6	Bromley, Ord. 10 p.c.	115—120*	..	5 0 0
165,700	,,	,,	4½	Do. do. 7 p.c.	88—93*	..	4 16 9
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	10⅝—11¼	..	6 4 5
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 10	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 26	5⅝†	Commercial Old Stk.	106—109	..	4 15 5
503,750	,,	,,	5†	Do. New do.	102—105	..	4 15 3
442,947	,,	June 11	3	Do. 4½ p.c. Deb. do.	87—90	..	5 6 8
800,000	Stk.	June 11	7	Continental Union, Ltd.	120—125	..	5 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
575,000	Stk.	Feb. 26	5½	Crystal Palace Ord. 5 p.c.	113—118	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
112,533	,,	July 10	5	Do. 5 p.c. Deb. Stk.	135—138	..	3 12 6
486,090	10	July 29	10½	European, Ltd.	17½—18½	..	5 13 6
354,060	10	,,	10⅝	Do. £7 10s. paid	12½—13½	..	5 16 8
15,243,200	Stk.	Aug. 13	4⅛	Gas-light and Coke	4 p.c. Ord.	85—87*	−2	5 1 2
2,600,000	,,	,,	3½		3½ p.c. max.	83—85*	..	4 2 4
3,799,735	,,	,,	4		4 p.c. Con. Pref.	104—107*	+1	3 14 9
4,193,975	,,	June 11	3		3 p.c. Con. Deb.	87—89	..	3 7 5
252,500	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.		90—95	..	5 5 3
70,000	10	June 11	8	Hongkong & China, Ltd.		15—16	..	5 0 0
3,800,000	Stk.	May 14	10	Imperial Continental		200—205	..	4 17 7
473,600	Stk.	Aug 13	3½	Do. 3½ p.c. Deb. Red.		99—102*	..	3 8 7
165,242	Stk.	Mar. 12	6	Lea Bridge Ord. 5 p.c.		115—120	..	5 0 0
561,000	Stk.	Feb. 26	10	Liverpool United A		220—222	−1	4 10 1
718,100	,,	,,	7	Do. do. B		167—169	+1	4 2 10
306,083	,,	June 26	4	Do. do. Deb. Stk.		110—112	..	3 11 5
75,000	5	June 11	5	Malta & Medn., Ltd.		4¼—4⅜	..	5 5 3
560,000	100	April 1	5	Met. of 5 p.c. Deb.		103—107	..	4 13 6
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.		102—104	..	4 6 7
541,920	20	June 11	3½	Monte Video, Ltd.		9—10	..	7 0 0
1,515,892	Stk.	Aug. 13	4½	Newc'tle & G'tesh'd Con.		98—101*	..	4 9 2
376,855	Stk.	July 3	3½	Do. 3½ p.c. Deb.		99—101	+2½	3 9 4
300,00c	Stk.	May 14	8	Oriental, Ltd.		140—145	..	5 10 4
600,000	5	Mar. 31	7	Ottoman, Ltd.		5⅞—6⅞	..	5 7 8

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6⅛	Ply'mth & St'house 5 p.c	123—128	..	4 15 8
851,070	10	April 30	7	River Plate Ord.	10¾—11¼	..	6 4 5
300,000	Stk.	June 26	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
250,000	10	April 17	8	San Paulo, Ltd.	11⅛—12½	..	6 8 0
135,000	Stk.	Mar. 12	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	237—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	+1	4 3 8
103,235	Stk.	Mar. 31	5	Shrewsbury Ord. 5 p.c.	111—114	..	4 7 9
6,150,000	Stk.	Aug. 13	5⅛	South Met., 4 p.c. Ord.	121—124*	−1	4 6 0
1,780,000	,,	July 10	3	Do. 3 p.c. Deb.	88—90	..	3 6 8
380,940	Stk.	May 14	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	July 10	4	Do. 4 p.c. Deb.	102—105	..	3 16 2
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton A. 5 p.c. B. 3½ p.c.	117—122	..	4 18 4
313,020	,,	,,	4½		97—100	..	4 10 0
182,380	10	June 11	8	Tuscan, Ltd.	8—9	..	8 17 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
737,142	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.	93—98*	..	5 2 0
				WATER COMPANIES.			
780,776	Stk.	June 26	11½	Chelsea, Ord.	310—320	−10	3 11 11
150,000	,,	,,	5	Do. 5 p.c. Pref.	147—150	..	3 6 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	135—138	..	3 5 3
175,785	,,	Mar. 31	4½	Do. 4½ p.c. Deb.	137—142	..	3 3 5
1,720,560	Stk.	Mar. 31	8	East London, Ord.	2c0—220	−29½	3 12 9
654,740	,,	June 11	4½	Do. 4½ p.c. Deb.	138—143	..	3 2 11
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	93—96	..	3 2 6
700,000	50	June 11	10	Grand Junction 10 p.c. max.	122—127	−16	3 18 9
310,000	Stk.	Mar. 31	4		4 p.c. Deb.	123—128	..	3 2 6
708,000	Stk.	Aug. 13	10½	Kent	280—290*	−10	3 12 5
160,000	,,	,,	7	Do. New, 7 p.c. max.	190—200*	−5	3 10 0
1,043,800	100	June 26	11	Lambeth, 10 p.c. max.	295—305	−10	3 12 2
406,200	100	,,	8½	Do. 7½ p.c. max.	210—220	−10	3 17 3
350,000	Stk.	Mar. 31	4	Do. 4 p.c. Deb.	122—127	..	3 3 0
500,000	100	Aug. 13	12⅝	New River, New Shares	400—410*	−25	3 2 5
1,000,000	Stk.	July 29	4	Do. 4 p.c. Deb.	121—124	..	3 4 6
902,300	Stk.	June 11	7½	South-wark and Vauxhall Ord. 7½ p.c. max.	235—245	−25	3 1 3
126 500	100	,,	7½		210—220	..	3 8 2
489,200	Stk.	,,	5		5 p.c. Pref.	148—153	..	3 5 4
1,019,585	,,	Mar. 31	4		4 p.c. A Deb.	122—127	..	3 3 0
1,155,066	Stk.	June 11	10	West Middlesex	285—295	−10	3 7 10
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	136—141	..	3 3 10
200,000	,,	Mar. 12	3	Do. 3 p.c. Deb.	94—96	..	3 2 6

* Ex div.

† Next dividend will be at this rate.

one of 5½ per cent. However, this will allow them a carry-over of £1175. The business is growing; and though there are occasional complaints, the wants of the consumers are, on the whole, satisfactorily supplied. In the course of his remarks, the Chairman showed the proprietors how obstructive a Local Authority can make themselves when they feel disposed. He explained that the Aldershot Gas and Water Company applied to the Board of Trade for a Provisional Order giving them the power to raise additional capital. During the negotiations which took place previous to the application, the Aldershot District Council sought to have inserted terms which would have precluded the Company from supplying water to the Frimley or any other Company. In 1898, Parliament, by the passing of the Wey Valley, Frimley, and Farnborough Water Act, gave the Water Companies concerned the power to arrange to purchase or sell water to each other if they desired to do so. The Directors therefore felt that they were entitled, with the powers thus conferred upon them, to enter into an agreement with the Aldershot Company for their mutual benefit; and they considered it to be their duty to oppose the application of the Council to render tha greement inoperative. They went to the Board of Trade, and also called the attention of the War Office to the matter, and explained the position. The result was that the Board refused to interfere with the right of the two Companies to have the agreement, and disallowed the clause which the Council sought to have inserted. Not content with this, the Council took the matter to the House of Lords, and for the second time, he was glad to say, were defeated. Not content even then, they again petitioned when the Order reached the House of Commons. Up to the last moment they made out that they were going to fight the third time. He was glad to say, however, that wiser counsels prevailed; and at the last minute they withdrew their application.

Improved Water Supply at Maidstone.

In the report presented by the Directors of the Maidstone Water Company at the half-yearly meeting about this time last year, reference was made to a scheme in course of preparation by Mr. W. B. Bryan, M.Inst.C.E. (the Chief Engineer of the East London Water Company), the Company's Engineer, for improving the works. Though it has not been practicable to make a commencement with it, the present works, according to a statement made by the Chairman (Mr. H. W. Tyrwhitt Drake), at the recent half-yearly meeting, are in very good condition. He said they had been inspected by Dr. Sims Woodhead, whose report stated that the East Farleigh filters had not been renewed since October, but were nevertheless still working well within their capacity and were supplying 500,000 gallons of water per day. The Barming reservoir was favourably commented upon. At the Boarley springs, too, everything was clean and in good order. The Cossington springs were equally well protected. He considered that the Cossington and Boarley water supplies were among the most perfectly protected in the kingdom. At Forstal, he found everything in good order. With the exception of one or two very small details, he was unable to suggest any further improvement, and he was thoroughly satisfied with the cleanliness of the surroundings and the protection of the headings. The chemical report of Mr. Gregory stated that, except for very slight organic traces, the water left nothing to be desired. Mr. Bryan, in response to a request to address the meeting, said he could make very few suggestions. With respect to the new well at Forstall, he certainly must congratulate the Company, not only upon its yield, but upon the quality of the water. It had been tested on two occasions, and the output was certainly greater than the appliances could deal with, though the pumping plant was in most excellent condition. The Directors reported a profit of £6234; and they recommended dividends at the rates of 7½ and 5¼ per cent. per annum on the 10 and 7 per cent. shares. This was agreed to. These payments will absorb £1680, and leave £4554 to go forward.

A Flourishing Surrey Water Company.

The shareholders in the Sutton District Water Company held their 65th half-yearly general meeting a few days ago, under the presidency of Mr. W. E. Chambers, the Deputy-Chairman, in the absence, through illness, of Mr. W. Blaber, the successor of the late Sir Allen Sarle in the chair. They received from the Directors a very satisfactory report, showing a profit, including £1067 brought forward, of £5269; and a dividend at the rate of 10 per cent. per annum on the ordinary stock was recommended. This would absorb £3000; and, as it was proposed to place £1000 to the reserve account, a balance of £1269 would remain to be carried forward. In moving the adoption of the report, the Chairman stated that the gross rental had been £9771, or £880 in excess of that for the first half of the past year. He thought this ought to be exceedingly satisfactory to all the shareholders. Referring to the Act which the Company obtained in the session just closed, he explained that Parliament had allowed them to have £50,000 more capital, which they required on account of the softening of the water, which they had agreed to do. They had three years in which to carry out the necessary works; and he thought that this would be ample time. He hoped it would satisfy the people who wished to have this done; but he did not know whether those who drank the water would like its taste so well as before. But it would save them in other ways, as it would not furr up their pipes. Mr. Alexander Dickson pointed out that a considerable advantage might have been secured by making application to obtain the most recent proportions of loan capital to the share capital of the Company, as thereby they would have been able to carry on their works with cheaper money. The report was adopted, and the dividend recommended declared. The Company have issued a small pamphlet giving particulars of the origin and progress of the Company, from which we learn that for the year 1864 the rentals amounted to £308 only; and that by 1871 they had gone up to £2468. Ten years later, they reached £6996; at the end of the next decade, £10,268; in 1901 they were £18,210; and for the completed year 1902 they were £18,210. The original Secretary and Manager was Captain T. W. Aylesbury, on whose retirement in 1899, Mr. P. Anderson took the position.

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40 years'
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THE GLASGOW GAS ENGINEERSHIP.

The Question of Salary.

The Town Council of Glasgow on Thursday last had before them a recommendation in the minutes of the Gas Committee that they should advertise for a Chief Engineer and General Manager of the Gas Department, at a salary of from £1000 to £1200 per annum.

Mr. R. M. MITCHELL (the Convener) moved approval of the minutes.

Mr. GIBSON suggested that the better plan would be to advertise for a Gas Manager without mentioning any salary, and leave the various applicants from all parts of the kingdom to state the sum for which they would be prepared to undertake the responsibility. But he would not advertise at all if it were the opinion of some members of the Council that the position should be given to a local man.

Mr. MITCHELL said he could not agree with Mr. Gibson. The Committee would consider all the applications made, and the idea was to offer a fair salary in order to attract the best man they could get to succeed Mr. Foulis.

Mr. FORSYTH asked if the Committee had considered whether there was anyone at present on their staff fit to fill the position, because he should not like to invite applications from people all over the country, and afterwards appoint a local man.

Mr. W. F. ANDERSON said his fear was that the Corporation would be saddled with a man who might cost them £2000 or £3000 by doing things in a different way from that in which they had hitherto been done. If there was a local man who could fill the position, he thought they should take him.

Mr. O'HARE moved, as an amendment, that the minute be rescinded, and that the salary offered be from £800 to £1200.

Mr. BURGESS seconded the amendment.

Mr. GIBSON moved, as a further amendment, that in advertising all mention of salary should be deleted.

Bailie G. MITCHELL seconded this proposition.

Mr. O'HARE thereupon withdrew his amendment.

Mr. MITCHELL said he would accept the amendment on the understanding that the Corporation were prepared to give from £1200 to £1500 to any man the Committee might consider deserving of it.

Bailie FINLAY supported the original motion for the approval of the minutes. He said he thought this was a most extraordinary step for a Convener to take, especially after the Committee had deliberated fully on the matter, and considered it from every point of view.

Mr. MITCHELL said that surely, after hearing the views of the members of the Council, it was competent for a Convener to act in a way that was considered better.

Bailie ALEXANDER agreed with Bailie Finlay that the position taken by the Convener was altogether untenable. It would be a more manly course to approximate the value of a Gas Manager. If there was any mistake in the minute, it lay in this, that too small a salary was offered. From £1000 to £1200 was not too much to pay for the Manager of the gas-works at Glasgow.

Bailie WATSON agreed as to the desirability of getting the very best man for the post; and he moved that they advertise the minimum salary at £1000 and the maximum at £1500 per annum.

Mr. KENNEDY seconded the proposal.

On a show of hands, Mr. Gibson's amendment was carried over Bailie Watson's by 33 votes to 14. The amendment was then put against the motion for the approval of the minutes, and carried by 32 votes to 25.

[The advertisement, drafted in accordance with the decision of the Council, will be found in another column.]

THE ACETYLENE ASSOCIATION.

The Executive of this Association, which was formed for the advancement of acetylene gas engineering and manufacture, have issued a *précis* of their transactions since the general meeting in February. It opens with an expression of regret at the loss of the energetic co-operation of the Chairman (Mr. F. G. Worth), whose ill-health has prevented him rendering the Association his customary valued assistance. Another regrettable matter has been the failure of the organ of the Association—the "Journal of Acetylene Gas Lighting." Among other matters referred to in the *précis* is some correspondence the Secretary had with the Local Government Board early in the year, as to an intimation by the Department that some doubt had arisen as to their power, under the Public Health Act, 1875, to issue an Order to enable a District Council to undertake the supply of acetylene gas. The outcome of the correspondence was to elicit a statement that, in the event of an application being received by them, it would be considered with reference to the actual facts of the case. The Executive regard this statement as reassuring. Other questions dealt with are the storage of carbide in England and the testing of purifiers and purifying material. Acknowledgment is made of the services rendered to the acetylene industry in this country by Dr. F. Rose, His Majesty's Consul at Stuttgart, by his articles in the technical journals and his very valuable consular reports. The attention of Lord Lansdowne was called to these services in a letter signed by all the members of the Council of the Association accessible in London; and his Lordship, in reply, has expressed his pleasure in placing on record this appreciation of Dr. Rose's work.

The total rainfall of June and July this year has not been equalled in 45 years. Three days in one month (June) with a rainfall exceeding an inch is unprecedented; and five days with a fall exceeding an inch in a period of 41 days is also unexampled in this country.

RICHMOND'S

SHAMROCK.

RICHMOND'S COOKERS

C.GLOVER'S DRY METERS

G.NEWTON'S WET METERS

Sees High Sales.

SIR THOS. LIPTON'S

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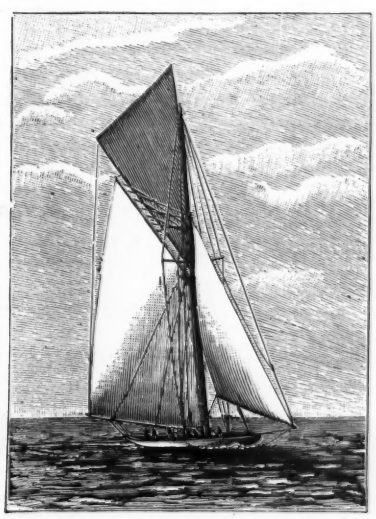

Sails High Seas.

ADVERTISEMENT OF THE RICHMOND GAS STOVE AND METER CO., LTD., ACADEMY WORKS, WARRINGTON, AND CARPENTERS RD., STRATFORD, LONDON.

PROGRESS OF GAS SUPPLY IN LIVERPOOL.

The Chairman of the Liverpool United Gaslight Company (Sir Edward Lawrence) delivered an unusually interesting address when moving the adoption of the report at the annual general meeting on Tuesday, a report of which appears elsewhere. In the course of his remarks, he stated that the Company had sold 3596 million cubic feet of gas in the twelve months ending the 30th of June, compared with 3579 million cubic feet in the preceding twelve months. Commenting upon the position of the Company, the "Liverpool Courier" characterizes the former quantity as "prodigious," and remarks that the figures would have startled the Manager of the Company in the early days of the undertaking, which, it appears, was established about 84 years ago. According to the writer of the article, gaslight had been seen in Liverpool before that time, for two experimental lamps, with three burners in each, were erected near the Town Hall in the year 1816, and were naturally viewed with a good deal of interest by the townsfolk, though many of them doubted the power of gas to beat oil lamps and candles out of the field. There were some people, too, who were rather fearful of the mysterious flame emitted from the top of metal pipes attached to wooden posts; and they could hardly be induced to touch the pipes lest they should burn their fingers. He explains that these experimental gas-lamps were intended to "give an impetus to the Company which was being formed with a capital of £10,000, in shares of £50 each." He then gives the following historical sketch of the Company: "Despite the bright lamps in front of the Town Hall, the undertaking crept very slowly in popular favour; and it was not until 1818 that the necessary parliamentary powers were obtained. Then gas was introduced into streets, houses, and business premises, gradually overcoming popular prejudice, and proving that it was cheaper as well as lighter than the oil-lamps and 'dips' hitherto in use. As there seemed to be money in it, another Company started in 1823. This was the Liverpool Oil Gas Company. . . . But it was not until 1836 that the gas lighting of the streets extended beyond the bounds of Liverpool parish, and even within that favoured area the lamps were few and far between, while there were none in back lanes or in the dismal courts and alleys. The Directors of the Oil Gas Company were not long in discovering that coal was preferable to oil in their business, and they accordingly changed their manufacture; and in 1848 the two local Companies were amalgamated, and adopted the designation of the Liverpool United Gaslight Company." The writer does not conclude his interesting remarks without making reference to the competition the Company have had to sustain during comparatively recent times, and the attacks to which they have been subjected. About 25 years ago, an agitation was commenced to induce the Corporation to acquire the undertaking, and provide the public with cheaper and better gas; but it fell through. Then there came the introduction of electric lighting, which consoled the municipalizers for the failure of their purchase scheme. However, as the writer of the article remarks: Sir Edward Lawrence convinced the shareholders that there is still a good deal of life left in the Gas Company, who help the people "to cook their victuals as well as light their dwellings and business premises, while the incandescent mantles have endowed gas with a brilliance which many persons consider better than the electric light." There can be no greater proof of the Company's vitality than the gradually increasing demand for their commodity, the sale of which has gone up something like 400 million cubic feet in the past ten years.

ROYAL COMMISSION ON COAL SUPPLIES.

First Report.

The Royal Commission which was appointed on Dec. 26, 1901, to inquire into the subject of the coal supplies of the country have just made their first report. The work assigned to the Commission was to investigate the following matters: "The extent and available resources of the coalfields of the United Kingdom; the rate of exhaustion which may be anticipated, having regard to possible economies in use by the substitution of other fuel, or the adoption of other kinds of power; the effect of our exports of coal on the home supply, and the time for which that supply, especially of the more valuable kinds of coal, will probably be available to British consumers, including the Royal Navy, at a cost which would not be detrimental to the general welfare; the possibility of a reduction in that cost, by cheaper transport, or by the avoidance of unnecessary waste in working through the adoption of better methods and improved appliances, or through a change in the customary term and provisions of mineral leases; and whether the mining industry of this country, under existing conditions, is maintaining its competitive power with the coalfields of other countries."

During the month of January following, several meetings were held at which the general methods of procedure were discussed and settled; and on the 28th the Commissioners decided that, for the purpose of ascertaining the available coal resources of the kingdom, it was expedient to group the known coalfields into districts, and to place each district in the charge of one or more members of the Commission. Seven districts were ultimately agreed upon: (A) South Wales, Monmouthshire, Forest of Dean, Bristol and Somersetshire; (B) North and South Staffordshire, Warwickshire, Leicestershire, Shropshire, and a small portion of South Derbyshire; (C) North Wales, Lancashire, and Cheshire; (D) Yorkshire, Derbyshire, and Nottinghamshire; (E) Durham, Northumberland, Cumberland, and Westmorland; (F) Scotland; and (G) Ireland. As soon as the reports of the District Commissioners have been received, the Commission will proceed to inquire into the available coal resources of the United Kingdom, so far as they are contained in Kent and in concealed or unproved coalfields lying outside the areas covered by the investigations of the District Commissioners. Two Blue-books—one consisting of minutes of evidence

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C. & W. WALKER, LTD.,

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and an appendix, and the other containing plans, curves, and diagrams —accompany the report.

The evidence bears mainly upon the following points: (1) The limit of depth in mining; (2) the minimum thickness of workable seams of coal; and (3) waste in working. In reference thereto, the Commissioners say: "Inasmuch as our inquiry is not yet completed, we refrain at this stage from offering any opinion or recommendation based upon the information thus far received. On March 18, 1902, circulars were issued to all colliery owners in the United Kingdom inviting their assistance, and asking for certain specified particulars concerning their holdings or royalties. At the outset, a number of the colliery owners were unwilling, for various reasons, to supply the information asked for. Subsequently, however, when we had an opportunity of discussing the matter with them, and of explaining the object and purposes of our inquiries, this difficulty was largely overcome, and at present, except in some isolated cases, the local investigations are proceeding regularly and satisfactorily. Generally the coal owners and other persons interested in the coal-mining industry have cordially co-operated with the District Commissioners, and have rendered them invaluable assistance in their labours. In addition to the oral evidence, we have received a large amount of information in the shape of reports, memoranda, and letters bearing more or less upon this branch of the inquiry. These have been carefully considered by the Commission, and the most important of them will be found in the appendix." The report is signed by Lord Allerton, Sir W. Thomas Lewis, Sir George J. Armytage, Mr. A. Currer Briggs, Mr. Edward Hull, Sir Lindsay Wood, Mr. J. J. H. Teall, Mr. Thomas Bell, Mr. Charles Lapworth, Mr. James S. Dixon, M. Joseph Paton Maclay, Mr. Harold B. Dixon, Mr. Arthur Sopwith, Mr. W. Brace, and Mr. Ralph Young.

NEW JOINT-STOCK COMPANIES.

Under the title of Körting Brothers, Limited, a Company has been formed, with a capital of £50,000, in £5 shares, to acquire the business of electrical, mechanical, hydraulic, gas, heating, and ventilating engineers carried on by B. E. Körting in the United Kingdom and the Isle of Man, under the style of Körting Bros., and to continue the same and the business of manufacturers of, and dealers in, machinery, apparatus, and appliances; and to act as managers of, or agents for, other companies or firms, owners of patents and inventions, &c. The Colombian Petroleum Company, Limited, has been registered with a capital of £100,000, in £1 shares, to adopt an agreement with the Bolivar Syndicate, Limited, for the acquisition of a concession from the Government of Colombia; to hold, work, sell, or otherwise turn to account, the concession; to acquire any other property, rights, or options in Colombia or elsewhere; to prospect or explore for petroleum, coal, asphalte, guano, and natural gas; and to carry on the business of winners and workers of, and dealers in, such substances.

CONSOLIDATED GAS COMPANY OF NEW YORK.

Issue of Additional Capital.

In the "JOURNAL" for the 9th of June (p. 649) we gave some particulars in regard to a large scheme which the Consolidated Gas Company of New York have projected for the concentration of the gas supply of the city, and in the carrying out of which their Chief Engineer (Mr. W. H. Bradley) is engaged. This gentleman, it may be remembered, was recently in Europe studying the latest types of gas-works plant; and it was then that he courteously favoured us with the outlines of the scheme which have already appeared. The changes contemplated will, of course, involve a large outlay of money; and therefore it is with no surprise that we learn, from a recent issue of the "New York Herald," that the shareholders are to have the privilege of subscribing for approximately $6,000,000 of fresh capital, which will be offered, on a certain percentage, at $150 per share. About $9,000,000 of additional capital is to be raised; and it will all be payable on the 15th prox. According to the above-named authority, practically the whole of this sum will be expended in connection with the removal of the Company's plant from Manhattan Island to Lawrence Point, Long Island (as mentioned in the article already referred to), and the transmission of the gas through the tunnel between the city and Ravenswood. According to the "Commercial and Financial Chronicle," the authorized capital of the Company is $80,000,000, of which $6,822,000 is in the treasury. In recent years, almost entirely for the purpose of acquiring property, the stock of the Company has grown rapidly. Prior to March, 1900, the capital was $39,078,000. It was raised to $54,595,200 at that time in order to complete the purchase of the undertaking of the New York Gas, Electric Light, Heat, and Power Company. In July, 1900, a further increase to $80,000,000 was authorized, to acquire the works of the New Amsterdam and Standard Gas Companies, thereby bringing to an end the famous gas war which waged in the city for many months during 1899 and 1900. In addition to the present authorized capital stock issue of $80,000,000, the Company have, together with that of its controlled gas and electric light and power companies, a funded debt of $72,188,391. The price of the new stock will be the same as that of the previous issue, in 1900.

Water Supply in Mid-Sussex.—At the last meeting of the Cuckfield Rural District Council, it was announced by the Chairman (Major J. J. Lister) that the increase in the quantity of water available since the heading had been started in the well at the Balcombe Water-Works amounted to upwards of 55,000 gallons a day; making the total quantity pumped daily 221,000 gallons. It was thought there was a great quantity of water close to them; and he had every hope they would tap a permanent supply, and not have to go to any great expense.

No. 26—New Model.
"SYPHON" RADIATOR.

PURE HEAT.

WITHOUT SMOKE OR SMELL.

CLARK'S PATENT

"SYPHON" RADIATORS.

NO FLUE - - -
- IS REQUIRED.

No. 24—New Model.
"SYPHON" RADIATOR.

VERY POWERFUL STOVES
OF ARTISTIC DESIGN.

WRITE FOR CATALOGUE OF NEW DESIGNS FOR SEASON 1903-4.

S. CLARK & Co., Patentees and Makers, Compton Works, Canonbury Road, Highbury, and Syphon Works, Islington, LONDON, N. Show-Rooms: 58, Holborn Viaduct, E.C.

HUNSTANTON GAS AND WATER SUPPLY.

Suggested Extensions of Works.

The Hunstanton Urban District Council recently had before them a report on the alterations and additions suggested in the immediate future for the gas and water works. It was stated therein that Messrs. Stevenson and Burstal had reported that the water undertaking is in a very satisfactory condition; all liabilities being met from the receipts during the past financial year. The business had so much increased that the Engineers recommended an additional pumping-engine and a new boiler, to prevent any possibility of a breakdown. The duplicating of the engine would cost about £900, and the new boiler £500. The existing buildings would not have to be altered a great deal at present; but when a thoroughly satisfactory financial position was assured, new ones, more in accordance with the needs of a public authority, should be erected. The cost of a new pumping main would be £1400, and a further outlay of £1400 for mains throughout the district, with sluice-valves and hydrants, would, in the Engineers' opinion, be advisable—making a total outlay on the water undertaking of £4200. With reference to gas, the output for 1902-3 had increased 9·44 per cent. The works had now come to the end of their producing power, and it would be necessary to construct entirely new ones on the southern portion of the ground. Details of the alterations were given, showing additions to the coal-store, a winding-engine for raising the coal, a new retort-house, and the removal and duplication of the condenser and scrubber. They also recommended the erection of sulphate plant. A new gasholder would not be wanted immediately. The Engineers were careful to inform the Council that they could not assure them that by the construction of these works any great saving would be effected in the cost of manufacture; but they said that, owing to the growth of the undertakings, the extensions were absolutely necessary. It must therefore be to the future that the Council would have to look to recoup themselves for the cost. It would be for them to consider whether the whole or only part of the extensions should be commenced; but it would in their opinion, be cheaper to do all the work at once. The alterations to both the gas-works and the water-works were urgent, and should be taken in hand this year, so as to be ready, if possible, for next season's supply.

Barnet District Gas and Water Company.—At the meeting of this Company on Friday, the Directors will report a profit of £11,480 for the six months ending the 30th of June. The net profit is £9379; and dividends for the half year, less income-tax, at the rates of 7½, 6½, and 5¼ per cent. per annum on the several classes of stock will be recommended. The payment of these will absorb about £8240, and leave £1139 to add to the unappropriated balance, raising it to £13,805.

METROPOLITAN WATER BOARD.

The Companies' Claims and the Board's Answers.

The date specified by the Court of Arbitration under the Metropolis Water Act, 1902, for the deposit with their Clerk of the answer of the Water Board to the claim of the first Water Company on the list—the East London—was the 17th inst.; while the answer to the second claim, that of the New River Company, was to be sent in by yesterday. As a matter of fact, however, the two answers appear to have been submitted together; and their nature was made known on Thursday.

The statement of the first-named Company shows that the capital consists of debenture stock to the amount of £2,051,000, and of ordinary share capital to the amount of £1,720,000. The debenture stock is taken over by the Water Board, and in respect of their nominal capital of £1,720,000 the Company claim sums amounting in the aggregate to £7,214,000—basing their claim, apparently, on the suggestion that they are entitled in perpetuity to the maximum dividends prescribed by their Acts, and to a capitalization on the assumption that these dividends are more valuable than the interest upon Consols. The reply of the Board is generally to the effect that over and above the £2,051,000 charge, which they take over, they are not prepared to offer any further sum in respect of the undertaking. It is pointed out that inability to formulate any additional offer is mainly due to the fact that the available supplies of the Company are practically exhausted, and that the large district which is dependent upon them cannot be served in the future without very large additional expense. The Company, it is stated, depend largely upon the water of the River Lea, which is subject to serious pollution. It is also urged that the recent concessions made to the London Water Companies are to be treated merely as conferring such powers as were immediately necessary in the public interest, which powers were not to be a source of profit to the Companies, or go to enhance the price to be paid in case of purchase.

With regard to the New River Company, their share capital has a nominal value of £2,019,000, while the debenture stocks amount to about £2,250,000. As in the case of the East London Company, the latter are taken over by the Board; and in respect of the former the Company claim, under various heads, a sum of £11,666,000. The main point of the answer of the Board is that the sources of water which the Company are entitled to bring into account for the purpose of their claim will be wholly insufficient to meet the demands of the population of their district. The Company will be largely dependent upon their share of water obtainable by means of the Staines reservoirs scheme, in which they are partners with the Grand Junction and West Middlesex Companies; but, under the Staines Reservoirs Acts, it was provided that, in the event of purchase, the Company should not be entitled to bring into account or make any claim in respect of the advantages conferred upon them by, or resulting from, these Acts. The Board indicate

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that, in addition to the liability involved in taking over the debenture stocks of the Company, they are willing to pay in respect of the undertaking the sum of £3,000,000, which they say is more than sufficient to repay the amount expended by them upon the undertaking.

Under the orders made by the Court of Arbitration—which, as readers are aware, consists of Sir Edward Fry (Chairman), Sir Hugh Owen, K.C.B., and Sir John Wolfe-Barry, K.C.B.—the answers of the Board to the claims of the remaining six Companies have to be lodged at various dates during the month of September. The Court will meet for the consideration of the first claim on the 26th of October, as determined at the sitting of the Court, on the 29th of May.

THE QUALITY OF GOSPORT WATER.

Diverse Opinions of Experts.

At a recent Meeting of the Gosport District Council, the Chairman read reports received of analyses of several samples of water taken from the Foxbury well. Dr. Stevenson characterized the water as "organically pure, but not above suspicion, and not a satisfactory water for a public supply." Dr. R. Tanner Hewlett, of King's College, reported that the results of his examination of the water were very satisfactory. He said it was one of "considerable purity." The report from the Clinical Research Society was that the water was "very saline, and decidedly hard." Except for these defects, however, it would be a "good drinking water." In a second report from King's College, it was stated that, so far as chemical analysis furnished evidence, the sample of water examined might be considered as "suitable for drinking and domestic purposes," being very free from objectionable organic contamination. The reports were received by the members with feelings of satisfaction; and it was decided to consider them at a future meeting. This was held on Friday night, when three hours were occupied in discussing the subject. Its importance will be appreciated from the fact that not only have Surgeon Reid, and others living in the district, repeatedly complained that the water supplied by the Gosport Water Company is mixed with an inflow of sea water, but the War Office and the Admiralty have sought explanations, considering the interests of the naval and military people who are affected. The analyses made by experts have differed. Dr. Hunter, the Medical Officer of Health, stated that, as one report had certified that the water was of considerable purity, and was suitable for drinking purposes, being free from sewage contamination, he believed it could not be at present in the slightest degree injurious to health. Dr. Thresh, who had been employed by the Company, certified that the water chemically showed no sign of pollution by animal matter, but that it contained a small proportion of sea water, rendering it hard. "As both the chemical and bacteriological examinations gave no indication of sewage contamination, the water is in this respect most satisfactory in character," was Dr. Thresh's concluding phrase; and yet one member of the Council characterized the water as being "vile, beastly stuff," which he had for two or three years been compelled to drink. It was suggested that copies of the analyses should be forwarded to the Admiralty and the War Department; but eventually an amendment was carried that, "having regard to the high percentage of chloride in the water, it would warrant that application should be made for an inquiry by the Local Government Board."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There was a discussion in the Glasgow Town Council on Thursday upon the proposal of the Gas Committee to offer a salary of from £1000 to £1200 for an Engineer and General Manager of the Corporation Gas Department. In all Corporations, there are some who consider that the salaries of officials should be kept rigorously down; and there are others who hold that, unless a good salary be offered, a good man will not be got, and that the undertaking will lose more by appointing an incapable man at a low salary than they would by employing a capable man and paying him well. Both of these classes were represented in the Council. The decision is to offer no specified sum. It is understood, however, that the Gas Committee will not be tied in the matter, but will be in a position to give at least the salary they proposed.

The Glasgow Town Council, on Monday, agreed to estimates which had been prepared by the Watching and Lighting Committee for the current year. For lighting, the estimate is £91,068—an increase of £2484 over the actual expenditure last year.

Ex-Provost Brownlee, a member of the Dundee Town Council, though not a very useful one, has a personal grievance with respect to the amount of his gas bill. On Monday, sitting in the Tramways Committee, he mentioned that, notwithstanding the facts that the price of gas had been reduced, and that he had been out of his house for forty days, his gas bill for the past quarter was only 6d. less than that for the corresponding quarter of last year. It was suggested by several members that more gas must have been used while he was at home; but ex-Provost Brownlee declined to accept such an explanation. On the following day, he brought the subject before the Gas Committee. An explanation having been asked from the Manager, Mr. Yuill stated that last year there were many complaints as to the quality and the pressure of the gas in the locality where ex Provost Brownlee resides, and that the fault, which had been remedied, would, to some extent, account for the increased bill. He would, however, examine the matter and report to another meeting.

An action has been called before Lord Pearson, in the Court of Session, at the instance of Thos. Chapman, of Commonhead, Airdrie, and others, against the Coatbridge Gas Company. The conclusions of the action are for declarator and interdict. This is all the official information which is given; but I am able to add that the litigation has arisen over the proposal of the Company to supply gas within the

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burgh of Airdrie. It is a little strange that the action has been taken by shareholders of the Company. It is a somewhat interesting situation. The Company is a statutory body. Possessing power to supply gas in the parish in which the town of Airdrie is situated, they gave notice of that power at the time when it was all but settled that the Town Council of Airdrie were to take over the undertaking of the Airdrie Gaslight Company. Had they not sought to retain their statutory powers at that time, the Corporation would have superseded them, and powers which the Coatbridge Company had deliberately acquired would have been lost. The action of the Coatbridge Company necessarily led to the abandonment of the transfer in Airdrie. This was followed by a petition by residents in a locality which is within the boundaries of the burgh of Airdrie, asking the Coatbridge Company to supply them with gas. Probably this step was taken with a view to the testing of the powers of the Company; but most probably it was due to the fact that Coatbridge gas is cheaper than that of the Airdrie Company. Be that as it may, the event showed that the Coatbridge Company were prepared to give the supply. Then the most strange thing of all in the matter has happened, in the bringing of this interdict, which is at the instance of shareholders in the Coatbridge Company. Defences are being prepared by the Coatbridge Company; and until these are lodged and the record made up, the pleadings of the parties cannot be made public. The situation is, however, sufficiently interesting to be worth watching when the time comes. A new development has come into the situation, in a resolution by the Airdrie Gas Company to apply for a Provisional Order granting them incorporation. This was agreed to at a general meeting of the Company which was held yesterday. If it should be granted, it would place the Company upon the same footing as the Coatbridge Company. As to the Order being allowed, there is likely to be no difficulty, for it is difficult to conceive opposition on the general question. On the particular question of boundaries, there will probably be opposition—or rather a conflict between the two Companies; and the chances are that the Coatbridge Company, being presumably in possession, will prevail. It is scarcely likely that a parliamentary tribunal will interfere with boundaries which have been already fixed by Parliament, and which are at present the subject of litigation. They cannot be expected to grant new boundaries while the old are in dispute; and therefore it will be to the interest of the Airdrie Company to get the Court of Session action out of the way as quickly as possible.

The accounts for the past year of the Perth Corporation Water Department show a revenue of £22,530; but of that, there was £13,771 in hand at the beginning of the year. The amount recovered by assessment was £7825. There has been transferred from revenue to capital account a sum of £12,383; and £605 has been placed to sinking fund. Management and maintenance cost £3894, and general administration £462. The water supply is pumped from the River Tay.

On Thursday afternoon, there was a breakdown of the electric lighting in Dundee. A dense thundercloud spread over the city, producing darkness which drove many to the use of artificial light. Those who are in the habit of burning gas were able to light up their premises without inconvenience; but users of the Corporation electric current found that it was not at their command at the moment. There was much inconvenience then and in the evening, when Reform Street—one of the leading thoroughfares—was in darkness. The inefficiency in the electrical plant was known to the officials; and a breakdown was not unexpected. At present they are engaged in the work of changing the supply from a 100 to a 200 volt one; and one of the officials has stated that, so great are the difficulties to be encountered, they do not anticipate they will be able to avoid other breakdowns.

The accounts of the Greenock Corporation Gas Department for the past year, to which I referred last week, were before the Corporation on Tuesday. As stated, the surplus on the year's working was £4533. The Gas Committee recommended that this be applied (1) in payment of £702 standing in the stock-book for repairs to the retort-bench; (2) in wiping out a sum of £246 10s., being the balance of the price paid for the commutation of the royalty on the oil-gas plant; (3) in wiping out a debit balance of £1909 standing in the revenue account; and (4) in carrying to the reserve fund the balance of £1676. Treasurer Brown said the surplus was one which the Gas Committee and the officials might well congratulate themselves upon, as it had been made under the very worst possible conditions, and solely with hand labour; the machines never having been at work once during the year. Though they were not able to reduce the general rates of the town, the consumers might look forward to a reduction of at least 5d. per 1000 cubic feet. Might he ask the Gas Committee not to entirely forget the general ratepayers? If they were not prepared to assist directly, they might well do so indirectly, by reducing the cost of gas for public purposes, which was being done in most towns. In one case, where a company had a monopoly, gas for the public lighting was supplied free. Mr. Morrison, the Convener of the Gas Committee, in moving the approval of the accounts, said it was estimated that the surplus for the past year would be £2756; the price of gas having been fixed to provide for payment of the balance at the debit of the revenue account. Now that the deficiencies of 1900 and 1901 had been wiped out, it would, he thought, be well also to wipe out some of the hard things which were said about them, and to remember that the price of coal had largely determined the financial results. It was expected that last year's reduction in price would have led to an increase in the demand for gas; but this had not been realized, and the revenue from the sale of gas was £1200 less than the estimate. But while the gas made had gone down by about 3 per cent., that sold had fallen by less than 2 per cent., and there had been a saving of 1 per cent. in the unaccounted-for gas. While the last item was higher than it should be, it was satisfactory that its rapid increase had been checked. It was expected that £8000 would have been received for residuals; but the amount was £8855, which was £1224 more than in the previous year. The ordinary expenditure, other than that for coal, was estimated at £20,273, and it had amounted to £19,714. The Manager deserved to be complimented on having kept so far within the estimate under conditions of much difficulty, arising from the extensive improvements effected during the year. It was estimated by the Manager that £20,081 would be required for coal; and that the average quality of the gas would be

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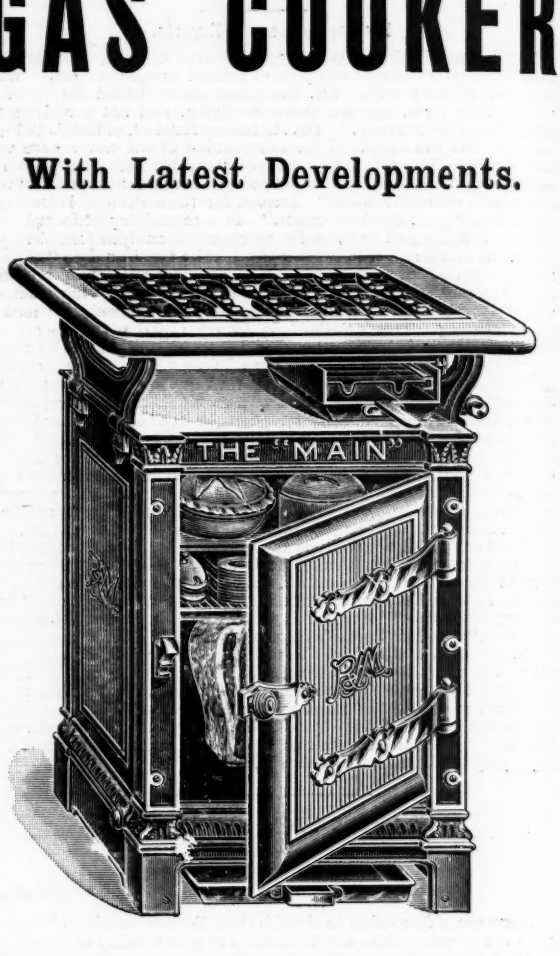

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over 23 candles. The Committee, being very desirous that the quality of the gas should be maintained, and that there should be no financial necessity for its reduction, increased the sum provided for coal to £21,000. But the amount expended, including that upon benzol, was only £19,012—a saving of £1988, about one-third of which was due to the reduced make of gas. While the saving, in itself, would be welcome to the Corporation, it was not satisfactory, either to them or to the consumers, that the average quality of the gas should have fallen below 21 candles. He should have preferred that the gas had been better and the surplus less. The increased revenue from residuals, and the saving in working expenses, made up for the reduced revenue from the sale of gas; and the saving in coal more than accounted for the extent to which the actual surplus of £4533 exceeded the estimated surplus. It was not proposed that any part of the surplus should be handed over to the Corporation in reduction of rates. The unfairness of such a policy was now very generally admitted. It was proposed to write off certain amounts of questionable value, and to carry the balance to a reserve fund, which was urgently needed in view of the fluctuation of the coal market. The accounts were approved. It is to be observed that there was no criticism of the management of the gas-works this year; everyone being agreed that the results which have been attained have been very creditable to the Manager. It is further to be noted that acknowledgment was made of the fact that all this has been done by means of hand labour; the stoking machinery not having been at work. This is another feather in the cap of the management. When it comes to be a case of getting favourable working results out of unfavourable working conditions, Mr. Ewing can hold up his face in any assembly of gas managers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 22.

Sulphate of Ammonia.

There has been an improved tone in the market, and more buying; but so far this has not resulted in a recovery in values, the closing quotations remaining £12 2s. 6d. per ton f.o.b. Hull, and £12 5s. per ton f.o.b. Liverpool and Leith. The best feature in the situation has been the larger proportion of direct buying; the bulk of the business in previous weeks having been for covering contracts for August delivery. In the forward position, £12 5s. per ton has been accepted for October-March delivery, ordinary terms, f.o.b. Leith; but at the close makers require an advance upon this price. There are still speculative sellers at a discount on prompt prices, but only for near months.

Nitrate of Soda.

Nitrate of soda is very firm in all positions; and, though not much business is being done for forward shipment, the firmness of producers precludes any shading of prices. The spot quotations remain 9s. 9d. and 10s. per cwt. for ordinary and refined qualities respectively, though prices at Continental ports are about 6d. per cwt. less.

LONDON, *Aug.* 21.

Tar Products.

There is very little business to report; the markets being generally quiet. A further quantity of 50 90 per cent. benzol has been sold for home consumption; and the demand for 90 per cent., for gas enriching, continues good. So that at present the values of this article are fairly well maintained. The market for pitch is rather easier, especially for forward delivery, several second-hand parcels having been offered at reduced prices. The demand for South Wales, however, continues fairly good, especially for prompt delivery, some of the fuel makers appearing to be short of stock. The demand for 60's crude carbolic continues good at 1s. 6d.; but consumers decline to pay any advance on this price. There are now buyers of creosote in both London and the North. But makers are not at all anxious to sell; while consumers are not inclined to pay any advance on existing prices. In toluol, an offer of 6¼d. is reported to have been declined for ordinary; but there are sellers at 6⅜d. for prompt delivery. In solvent, several parcels of specially fine quality have been sold for home consumption; but as regards export, there is no demand. In tar, there is nothing of any importance to report. The position remains the same; but prices have rather a downward tendency.

The average values during the week were: Tar, 24s. to 32s. Pitch, London, 54s. 6d. to 55s.; east coast, 53s. to 53s. 6d.; west coast, 51s. to 51s. 6d. Benzol, 90 per cent., 9d.; 50-90 per cent., 7d. Toluol, 6¼d. to 6⅜d. Crude naphtha, 2⅜d. to 3d.; solvent naphtha, 7d. to 8d.; heavy naphtha, 9d. Creosote, London, 1⅜d. to 1½d.; North, 1d. Heavy oils, 2⅛d. Carbolic acid, 60 per cent., 1s. 6d. Refined naphthalene, £5 to £8 10s.; salts, 22s. 6d. to 25s. Anthracene, "A" quality, 1¾d. to 1⅞d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market has been fairly steady during the past week; and there is not very much business doing. The Gaslight and Coke Company still quote £12 7s. 6d. in any position, but have not been able to realize this price, buyers' ideas being from 1s. 3d. to 2s. 6d. under this. Another large London Gas Company placed a considerable quantity for prompt delivery at £12 6s. 3d., and are not offering at the moment. In Hull, business is reported at £12 3s. 9d.; but only to a limited extent. Makers ask £12 5s.; but buyers offer only £12 2s. 6d. In Leith, makers generally ask £12 5s.; but business has been done at £12 3s. 9d. for prompt. In Liverpool, sales are reported at £12 3s. 9d. for prompt, but only for a small quantity. The markets generally are quiet; and the inquiry is at present rather more for forward than prompt delivery.

Lord Peel sat as independent Chairman of the South Wales Coal Conciliation Board, at Cardiff, on Friday, to discuss the masters' demand for a reduction in wages of 8¾ per cent. His Lordship came to the conclusion that they had not made out their case; and he decided against the reduction. Upwards of 100,000 men are affected by the decision.

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COAL TRADE REPORTS.

Lancashire Coal Trade.

Except that here and there a little more inquiry is reported for house-fire coals, as consumers are returning from their holidays, and, in anticipation of possibly higher prices, are getting in their winter supplies, there is little or no change to report in the general condition of the coal trade throughout this district. The output is still being kept down as nearly as possible to actual requirements, to prevent the accumulation of any large stocks. Some pits are not putting in more than two days, with others three, and only in exceptional cases four, days per week. For house-fire qualities, except where buyers are in a position to take quantities promptly either for stocking purposes or for immediate distribution, prices are being well maintained. But at present there is no talk of any upward move, nor is one at all likely with the close of the month, although there are anticipations that October may see some move in a hardening direction. Best house-fire coals average 13s. 6d. to 14s. 6d. per ton at the pit, seconds 11s. 6d. to 12s. 6d., and common house-fire coals 9s. 6d. to 10s. 6d. In the lower qualities of round coal suitable for iron-making, steam, and general manufacturing purposes, only an indifferent sort of business is being put through; the numerous holiday stoppages of works in the surrounding districts, and the generally quiet condition of the large coal-using industries, tending necessarily to restrict requirements for these purposes. But inland prices are being very steadily held to at from 8s. to 8s. 6d. and 8s. 9d. per ton at the pit for steam coal. For shipment, however, there are still low quotations to effect clearances; and ordinary steam coal, delivered at the ports on the Mersey, can be bought readily at 9s. per ton, and in some cases a trifle less, with ordinary quotations about 9s. 3d. to 9s. 9d. The very small production of slack is preventing any large surplus of engine fuel coming on the market; and prices are generally firm at late rates, with a tendency in some instances to harden upon recent very low quotations. Common slacks range from 4s. up to 4s. 6d. and 4s. 9d. per ton at the pit, medium 5s. 5d. to 5s. 9d., and the best qualities 6s. 3d. to 6s. 9d.

Northern Coal Trade.

There is a good demand for coal; but supplies are adequate, and prices of some classes are thought to be a little weaker. In the steam coal trade, best Northumbrian steams are easier at from 10s. 9d. to 11s. per ton f.o.b., second-class steams are from 9s. to 9s. 3d., and steam smalls are about 5s. 6d. Generally, the steam-coal collieries seem to have fair orders on hand; and prices are maintained, except in a few instances. In gas coals, the demand for home use is a little fuller than it was, so that the output is now well taken up, as the exports are still heavy, though those for the Baltic show some signs of declension. Durham gas coals, for occasional cargoes, are quoted from 8s. 6d. to 9s. 6d. per ton f.o.b., according to quality. There is little to report this week as to contracts for gas coals. Gas coke is rather irregular; there being an increase in the production. Prices still vary, according to the position of the producers; as high as 14s. 6d. per ton f.o.b. being quoted for some of the best gas coke.

Scotch Coal Trade.

There is a good demand for almost all classes of coal; but the output is also very large, and prices keep much about the same. The tendency, if anything, is rather downward. The quotations are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 8s. 6d. to 10s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 245,157 tons—a decrease of 5750 tons upon the preceding week, and of 7967 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,674,546 tons—an increase of 193,914 tons upon the corresponding period.

Speaking on Thursday at the first statutory meeting of the Company which bears his name, Mr. George M. Callender referred to the leakage of water from the reservoirs on the Rand in South Africa. He said he had it on the authority of an eminent engineer acting for some of the large groups of gold mines, that scarcely a dam was water-tight. When they bore in mind the fact that water was worth 2s. 6d. per 1000 gallons, they would see that it was of the utmost importance for economical working that no water should be wasted. In this connection, he mentioned that another engineer told him that their water was costing them upwards of £900 per month; and that the loss from leakage which they had been able to gauge, but which was probably much larger, amounted to at least £400 worth of water per month.

Value of Good Public Lighting.—The General Purposes Committee of the Wisbech Town Council have under consideration some alteration in the public lighting of the town; and pending the settlement of a contract with the Gas Company, they had before them a letter from the Borough Superintendent (Mr. J. Dockerill) setting forth his views on the matter. He said he had been informed that it was the intention of the Corporation to reduce the lighting hours of the lamps in the streets, and that they were to be put out (with the exception of a few) at midnight. He expressed the hope that the Committee would well weigh this proposal before coming to a decision. Being the Superintendent of the borough, and therefore responsible for the good order and safety of property, &c., he considered the lamps a very great protection; and, taking into consideration the great number of strangers in the town, and the mail train arriving about 2 a.m., the lamps were required as much in the early morning as in the evening. If the town was in darkness, any evil disposed persons could easily secret themselves in doorways or dark corners, and commit crimes of all descriptions, and the police would never see them. He considered the lamps one of the greatest protections; and he attributed the small amount of crime which occurred in the borough, and the fact that there were no serious crimes, in a great measure to the good lighting which the town enjoyed.

Cape Town Water Supply.—The Municipality of Cape Town propose to augment their present water supply, which is proving insufficient for the growing needs of the city. It is considered that by 1927 the population to be provided for will number half-a-million, and that the supply should be at least 30 gallons per head per day. Mr. R. O. Wynne-Roberts, Assoc.M.Inst.C.E., the Engineer to the Corporation, has made a detailed report on two possible sources for the needed increase of water. His choice has fallen on the Berg River Hoek watershed, which has an area of about 30 square miles; the mean annual rainfall on this area being about 64 inches, so far as can be at present ascertained. Most of the area in question is Government land, and is bare and rocky, so that but little will have to be expended on land appropriation. It is proposed to construct a reservoir capable of impounding about 10,000 million gallons of water by means of a concrete dam about 100 feet high above the valley bottom, and 652 yards long. From this dam a 40-inch steel main, 17¼ miles long, will connect with a balancing reservoir capable of holding 20 million gallons. Thence the water will be taken through a 30-inch steel main about 23 miles long, to a service reservoir, which, in turn, will be connected up by 4½ miles of 30-inch pipe with the existing Molteno reservoir. In all, the aqueduct will be 45½ miles in length. The total cost of the works is estimated at £1,668,000.

Abercarn Gas Supply.—At the meeting of the Abercarn District Council on Wednesday, the Surveyor (Mr. G. Stevens) presented a report on the subject of the acquisition of the gas-works by the Council. In the course, thereof, he stated that the amount the Gas Company were paid for their undertaking was £10,875; being £1755 more than the valuers had advised was its full worth. The parliamentary expenses amounted to £2010, or £1010 more than the estimated cost. There had been spent for renewals and on repairs to mains and services £1600, and £200 on meters, which sum was considerably over the estimated amount. It would be necessary to spend more money on meters. The total sum borrowed in respect to the undertaking was £18,710; and after deducting £1000 for working capital, it appeared that the anticipated estimated cost of £12,000 had been exceeded by £5910. The capital account was about £8000 higher than it ought to have been for the present output of gas, which showed that the Gas Company had had an excellent price for their property. No depreciation had been allowed for, and only £115 had been charged to the revenue account for repairs. There was an item in the last year's accounts which had been a serious one—viz., the unaccounted-for gas. In the last quarters it was 30·8 and 32·2 per cent. These two quarters had been unsatisfactory; but there was no reason why in future an average of 15 per cent. on the year's working could not be maintained. The saving in this item alone should be at least £300 a year. It was decided that the report should be considered by the Gas Committee.

Messrs. Joseph Taylor and Co., of Bolton, have secured orders for solid plate lead saturators for the Guernsey Gas Company and the Gas Department of the Sowerby Bridge Urban District Council.

Out of the profits on the gas undertaking of the Keighley Corporation, amounting to about £20,000, the ratepayers are to receive £3000 in relief of rates, and the gas consumers a reduction of 3d. per 1000 cubic feet.

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ASSISTANT TO GAS ENGINEER. Keighley Gas Department. Sept. 5.
CHEMIST (HEAD) FOR STEEL WORKS. No. 4079.
ENGINEER AND MANAGER. Broughty Ferry Gas Department. Aug. 29.
ENGINEER AND MANAGER. Glasgow Gas Department. Sept. 8.
FITTER AND SMITH. No. 4072.
MANAGER. Abergavenny Gas-Works. Sept. 16.
SUPERINTENDENT FOR EFFINGHAM STREET STATION. Sheffield United Gaslight Company. Sept. 12.
WATER INSPECTOR. Sittingbourne District Council.
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Situations Wanted.

HEAD STOKER OR YARD FOREMAN. W. R., Yeovil.
LECTURES ON GAS COOKING, &c. Madame Alting-Mees, London.
MANAGER: King, Halesworth.

Correspondence Classes in Gas Manufacture. No. 4081.

Meetings of Companies.

HARROW AND STANMORE GAS COMPANY. London, Sept. 9. One o'clock.

Meter Works and Plant, Sale by Private Treaty. T. & A. L. Brownson, Hyde.

Pupil Wanted. No. 4084.

Plant for Sale.

EXHAUSTER AND ENGINE, BOILERS, STEAM-HAMMER, MORTAR MILL, &c. No. 4073.
MOUTHPIECES, HYDRAULIC MAIN, PIPES, AND VALVES, &c., Robins, Sutton, Surrey.

Plant Wanted.

GASHOLDER TANK. No. 4085.

Tar-Works for Disposal. No. 4083.

Sales of Stocks and Shares.

PORTSMOUTH WATER COMPANY. Sept. 30.

TENDERS FOR

Steel Roof.

MANCHESTER GAS DEPARTMENT. Tenders by Sept. 3.

Tar and Ammoniacal Liquor.

CANNOCK AND HEDNESFORD GAS COMPANY. Tenders by Sept. 3.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SULPHATE OF AMMONIA

SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,

VICTORIA PAINT WORKS,
MANCHESTER.

Telegrams: "ENAMEL." National Telephone 1759.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are pre- pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

SULPHURIC ACID for Sale.

BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

MADAME ALTING-MEES, Con- férencière Diplomée, désire renouer ses relations avec les Compagnies Gazières, et leur offre ses Services pour des Séries de CONFÉRENCES sur l'Application du GAZ aux USAGES DOMESTIQUES.

S'adresser soit au bureau du "JOURNAL" ou à Madame ALTING-MEES, 102, Sinclair Road, Kensington, LONDRES, W.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
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THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

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SULPHURIC ACID.

SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.

SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

PUPIL.

GAS Engineer in large East Coast Town has a VACANCY for a PREMIUM PUPIL. Exceptional opportunity for gaining a splendid all-round Experience and Training.

Address No. 4084, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS MANUFACTURE EXAMINATIONS, CITY AND GUILDS.

CORRESPONDENCE CLASSES.

GENTLEMEN prepared for the above Examination, Honours or Ordinary Grade. The highest success. Two Medals last Examination; Seven Medals in Five Years. Confidential. Fees low.

Apply for Particulars to No. 4081, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Head Stoker or YARD FOREMAN in Works making about 50 Millions per annum. Good knowledge of Sulphate Making. Age, 38 Years. Height 6 ft. 2 in. Excellent Reference.

Address W.R., 24, Great Western Terrace, YEOVIL.

ADVERTISER seeks re engagement as MANAGER of Gas-Works up to 10 to 15 Million feet. 28 Years' practical Experience; 16 Years in present position. Can plan and carry out Extensions and Repairs in all branches, both Production and Distribution Departments, Prepayments and Cookers, &c. Good References.

Address GEO. KING, Manager, Gas-Works, HALESWORTH.

WANTED, a Working Manager for a Gas-Works at Hungerford, carbonizing about 6 Million cubic feet.

Apply, by letter, in own handwriting; stating Age, Qualification, and Salary required, to the SECRETARY, Hungerford Gas Company, Limited, 50, CANNON STREET, E.C.

SHEFFIELD UNITED GASLIGHT COMPANY.

THE Directors of this Company require a SUPERINTENDENT for their Effingham Street Gas-Works. (The position is vacant owing to the present Superintendent having been promoted.)

The maximum make of Gas at this Station is about 3½ Million cubic feet per day.

Salary £250 per annum, with House, Coal, and Gas free.

Applications, marked "Superintendent," stating Age, whether Married or Single, and previous Engagements, to be made by letter only, addressed to the undersigned, not later than Saturday, Sept. 12, 1903.

Testimonials not to be sent till asked for.

HANBURY THOMAS,
General Manager and Secretary.

Gas Offices: Commercial Street,
Sheffield, Aug. 22, 1903.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL.

5, CROOKED LANE, LONDON, E.C.

GLASGOW CORPORATION.
(GAS DEPARTMENT.)

TO GAS ENGINEERS.

THE Corporation invite Applications for the position of CHIEF ENGINEER and GENERAL MANAGER of their Gas Department, which has become vacant through the death of Mr. William Foulis.

Applicants, besides possessing Practical Experience in all matters relating to, and connected with, the Management of large Gas-Works, and the Manufacture and Distribution of Gas, must be qualified to prepare Designs and Specifications for, and to supervise the Construction of, such Works.

A liberal Salary will be paid to a thoroughly qualified and competent Engineer and Manager.

The successful Candidate will require to devote his whole time to the duties of the Office.

Applications, stating Experience and Qualifications, and accompanied by Thirty printed copies of not more than Six recent Testimonials, and marked "Gas Department, Application for Engineership," to be lodged with the Subscriber on or before Tuesday, the 8th prox.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
Aug. 21, 1903.

FITTER and Smith Wanted, used to the Routine of a Gas-Works. A qualified Mechanic preferred.

Apply, by letter, stating all Particulars as to previous and present Employments, Age, and Wages required, to No. 4072, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITTINGBOURNE URBAN DISTRICT COUNCIL.

WATER Inspector, thoroughly accus- tomed to the Deacon Waste-Meter System, required at once.

Apply, stating Age and Wages required, to CHARLES B. HARRIS, Clerk to the Council, SITTINGBOURNE.

WANTED, at a Steel Works, a thoroughly reliable HEAD CHEMIST. One with University education preferred. In addition to the ordinary routine of Steel Works Analyses, which must be correctly performed, he should have had experience in Gas Analyses, Analyses and Calculations arising in connection with the Products obtained from the destructive distillation of Coal, use of modern Pyrometers, &c., and the care and revision of records and upkeep of Instruments, Water Analyses and Water Softening, and Micrography. A man is required thoroughly versed in Theory and the Practical application of the same; and he must be a good Organizer.

Apply, stating Salary required, to No. 4079, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BROUGHTY FERRY GAS-WORKS.

WANTED, by the Town Council of the Burgh of Broughty Ferry a qualified GAS ENGINEER and MANAGER to take entire charge of their Gas Undertaking.

Salary, £225 per annum, with free House, Coal, Gas, and Taxes.

Candidates must not be over 45 Years of Age.

Candidates must state Age, Qualifications, and Particulars of Experience.

Applications, in writing, endorsed "Gas Engineer and Manager," and accompanied by Testimonials of recent date, to be lodged with the Subscriber on or before Noon of Saturday, the 29 curt.

Canvassing the Members of the Town Council, either directly or indirectly, will be a disqualification.

EDWARD COWAN,
Town Clerk.

4, High Street, Dundee,
Aug. 11, 1903.

BOROUGH OF KEIGHLEY.

THE Gas Committee are in want of a young Man as ASSISTANT to their Gas Engineer.

Applicants for the position must have Practical Experience in Gas Engineering, the preparation of Drawings and Specifications, the working of Regenerative Settings and Stoking Machinery, the Manufacture of Sulphate of Ammonia, Testing of Coal and Chemical Analysis, together with a thorough knowledge of Gas Supply and Distribution.

Salary, £150 per annum.

Applications, stating Age and Experience, and enclosing Testimonials, to be sent to the undersigned not later than the 5th of September next, sealed and endorsed "Assistant Engineer."

By order,
JOHN LAYCOCK.

Gas Offices: Cook Lane,
Keighley, Aug. 20, 1903.

ABERGAVENNY GAS-WORKS.

THE Town Council of Abergavenny are prepared to receive APPLICATIONS for the appointment of GAS MANAGER at their Gas-Works, Abergavenny.

Salary £160 per annum, with use of House, Coal, Gas, and Water.

Applications, in Candidates own writing, endorsed "Gas Manager," stating Age, Qualifications, and Experience, whether Married or Single, with not fewer than Three recent Testimonials, must be delivered to the Town Clerk, on or before Sept. 17, 1903.

It is necessary that Candidates should be experienced in the Working of Carburetted Water-Gas Plant, and in Regenerator Retort Furnaces and Settings.

The Council ALSO require the Services of a YARD FOREMAN for their Gas-Works. He must possess a thorough knowledge of Gas-Works routine, indoors and outdoors, and of Gas-Fitting, and be able to control the Workmen. Wages 40s. per week.

The make of Gas is about 43 Million cubic feet per Annum.

Applications, stating Age, Experience, whether Married or Single, accompanied by Two recent Testimonials, and endorsed "Gas Foreman," to be sent to the Town Clerk, Abergavenny, not later than Sept. 16, 1903.

J. T. RUTHERFORD,
Town Clerk.

Town Hall, Abergavenny,
Aug. 15, 1903.

WANTED, Gas Carbon, in Four Ton Lots or more, f.o.r. Must be Clean and Hard Lumps.

Address No. 4044, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Second-hand Cast-Iron GASHOLDER TANK, about 80 feet diameter by 20 feet deep, rust joints. Must be in good Condition and Water-tight.

State Age, Price, and where same can be seen, to No. 4085, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TAR Contracts Wanted on the Sliding Scale or at Fixed Prices.

Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

FOR SALE - 20-inch Valves, Tees, BENDS, CROSSES, &c., Second-Hand, Cheap. In Good Condition. Makers, Newton Chambers.

Apply to DUXBURY & Co., MANCHESTER.

TAR Distilling Works on Sale. Well- established business, large Connection, and Good Contracts.

Address No. 4083, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE SOLD, a Letheby Photometer, Edinburgh Model, with Dibdin 10-candle Pentane Apparatus, by W. Sugg and Co. Quite new; never having been fully used. If preferred, a candle-scale beam can be substituted for Pentane.

Apply to J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—One Gas Exhauster and ENGINE combined, by Tangye, for 10,000 to 15,000 cubic feet per hour. Good, Cheap.

Three EGG-END BOILERS 30 ft. by 5 ft., suitable for Tar or Liquor Tanks. Good.

One 5 feet MORTAR MILL, by Smedley. Good.

One 3 cwt. STEAM HAMMER.

Apply No. 4073, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—50 18 in. by 15 in. D-RETORT MOUTHPIECES, fitted with Tangyes' patent Lids; 6-inch Outlets.

30 18-inch Round RETORT MOUTHPIECES, fitted with Tangyes' patent Lids; 6-inch Outlets.

Three lengths Cast-Iron HYDRAULIC MAIN, with 4-inch Outlet and Valves.

18 6-inch ASCENSION, ARCH, and DIP PIPES for above, with 50 feet of 8-inch Foul Main and Connections complete.

One 8-inch Donkin's VALVES.

For further Particulars, apply to G. M. ROBINS, Gas Offices, Sutton, SURREY.

TO BE SOLD, by Private Treaty, the MACHINERY and PLANT of the NATIONAL DRY GAS-METERS, LIMITED, of 2, Victoria Street, Ashton-under-Lyne, together with the LETTERS PATENT for the manufacture of SCHOFIELD'S PATENT DIAPHRAGMS for use in Dry Gas-Meters.

The Machinery and Plant comprise: One No. 4 Drawing-Press to receive 20-inch Blank, fitted with Treadle Clutch Motion (Rhodes and Son); one No. 9 Capstan Lathe, complete with countershaft; one 8-Horse Power "O" type "National" (improved) Otto Gas-Engine, complete with one water-vessel; one 5-inch Capstan Lathe, complete with countershaft; one Roberts Disc Grinder, complete with usual Accessories; one quick-action Power Shearing Machine; one 10-feet Gasholder for Testing Meters; Drilling-Machine; Circle Cutting-Machine; Tinmen's Stoves; Grindstone; Wheel Cutting-Machine; Lever Fly-Presses; Index-Making Lathe, &c., &c.

The Machinery and Plant are complete for the manufacture of Dry Gas-Meters. They are for the most part new, and are all in excellent condition. The Purchaser could immediately commence manufacture.

The Machinery can be inspected by appointment.

Tenders for the whole are invited, and should be sent in writing to the undersigned not later than Sept. 5, 1903.

For further Particulars, apply to
T. & A. L. BROWNSON,
Solicitors, Hyde.

CANNOCK, HEDNESFORD, AND DISTRICT GAS COMPANY, LIMITED.

THE Directors of the above Company invité TENDERS for the surplus TAR and AMMONIACAL LIQUOR for Nine Months or One Year and Nine Months commencing Oct. 1, 1903.

Sealed Tenders, endorsed "Tender for Tar and Ammoniacal Liquor," and addressed to the Chairman must reach the Office not later than Sept. 3, 1903.

Further Particulars may be obtained from the undersigned.

T. A. NICHOLLS,
Secretary.

Gas-Works, Cannock.

MANCHESTER CORPORATION GAS-WORKS.

TO IRON AND STEEL WORK CONTRACTORS.

THE Gas Committee are prepared to re- ceive TENDERS for the supply, delivery, and erection of a STEEL ROOF over the No. 2 Retort-House at their Gaythorn Station.

General Conditions of Contract, Specification, and Bill of Quantities can be obtained from Mr. C. Nickson, Superintendent, Gas Department, Town Hall, on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

Drawings may be seen, and other Information obtained, on application to Mr. J. G. Newbigging, C.E., at his Office, Rochdale Road Station.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Steel Roof," must be delivered at the Gas Offices, Town Hall, not later than Twelve noon on Thursday, the 3rd of September, 1903.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Aug. 21, 1903.

Fifth Sale, Water Order, 1902.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

IMPORTANT SALE OF NEW ISSUE OF SHARES
IN THIS OLD-ESTABLISHED AND GOOD DIVIDEND-PAYING COMPANY.

LOVE & COOPER are favoured with Instructions from the Directors of the above Company to SELL BY PUBLIC AUCTION, at the Lower Albert Hall, Commercial Road, Portsmouth, on Wednesday, Sept. 30, 1903, at Seven o'clock in the Evening (in convenient Lots), the fifth portion of the New Issue authorized under the Borough of Portsmouth Water Order, 1902, consisting of

2000 SHARES OF £5 EACH

(fully paid), forming part of the New Ordinary Capital authorized under such Order.

The Auctioneers desire to call the special attention of Capitalists, Investors, and others to this very favourable opportunity of securing Shares in such a thoroughly sound Local Company.

The Shares will be sold *free of any charges*, Fees, or Expenses whatever to the Purchaser.

Full Particulars and Conditions of Sale may be obtained, with any further Information, from the Secretary of the Company, J. L. WILKINSON, Esq., F.C.I.S., at the Company's Offices, Commercial Road, PORTSMOUTH; or of the AUCTIONEERS, at their Offices, 14, Osborne Road, SOUTHSEA.

Telephones: Municipal and National, 103.

Price 10s. 6d., Green Cloth, Gilt Lettered.

VOL. LXXXII.

OF THE

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

GREEN CLOTH CASES for Binding the Quarterly Volumes of the "JOURNAL," Gilt Lettered, Price 2s.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HARROW AND STANMORE GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY MEETING of the Proprietors will be held at the Albion Tavern, Aldersgate Street, in the City of London, on Wednesday, the 9th day of September, 1903, at One o'clock precisely, to receive the Directors' and Auditors' Reports, to declare a Dividend, and to transact any Ordinary Business of the Company.

The REGISTER OF TRANSFER BOOKS WILL BE CLOSED from Sept. 2 until Sept. 9, both inclusive.

The Meeting will afterwards be made Extraordinary, for the following purpose: To authorize the Directors to issue £30,000 of Additional Capital, and to borrow on Mortgage, or by the Creation of Debenture Stock, £10,000 in respect of such Aeditional Capital, in pursuance of the Acts of Incorporation, in such manner and at such times as they may deem best.

By order of the Board,
J. L. CHAPMAN,
Secretary.

Gas Office, Roxeth, Harrow,
Aug. 21, 1903.

In the matter of the

WELSBACH INCANDESCENT GASLIGHT COMPANY, LIMITED AND REDUCED,

and in the matter of the Companies Acts, 1867 and 1877.

NOTICE is Hereby Given, that the order of the High Court of Justice, Chancery Division, dated the 8th day of August, 1903, confirming the REDUCTION of the CAPITAL of the above-named Company from £3,500,000 to £1,345,000, and the minute (approved by the Court) showing with respect to the Capital of the Company as altered the several Particulars required by the above Statutes, were registered by the Registrar of Joint-Stock Companies on the 14th day of August, 1903. And further Take Notice that the said minute is in the words and figures following:—

"The Capital of the Welsbach Incandescent Gaslight Company, Limited and Reduced, is from henceforth £1,345,000, divided into 1,500,000 Preference Shares of 13s. each and 1,350,000 Ordinary Shares of 5s. each, and 650,000 Deferred Shares of 1s. each, instead of the Original Capital of £3,500,000, divided into 300,000 Preference Shares of £5 each, 1,350,000 Ordinary Shares of £1 each, and 650,000 Deferred Shares of £1 each.

"At the time of the Registration of this minute, the whole of the said 1,500,000 Preference and 1,350,000 Ordinary Shares have been issued, and the sum of 13s. has been paid, and is to be deemed to be paid up on each of the said Preference Shares, and the sum of 5s. has been and is to be deemed to be paid up on each of the said Ordinary Shares. Of the said Deferred Shares, 629,539, Nos. 1,650,001 to 2,279,539, both inclusive, and no more have been issued, and on each of them 1s. has been and is to be deemed to be paid up. The remaining 20,461 Deferred Shares, Nos. 2,279,540 to 2,300,000, both inclusive, have not been issued, and nothing has been or is to be deemed to be paid up thereon."

Dated the 17th day of August, 1903.

FRANCIS AND JOHNSON,
of 19, Great Winchester Street,
in the City of London,
Solicitors for the Company.

NOTE: The reasons for the reduction of Capital above referred to are that the actual values of the under-mentioned assets of the Company are less by the sum of £2,135,562 and upwards than the values thereof as appearing in the Books of the Company and in the Balance-Sheet of the 30th of March, 1903. To the extent of the difference between such values (less the balance to credit of Profit and Loss and Suspense Account) the Capital of the Company is not represented by available assets.

Particulars of the Assets and Values hereinbefore mentioned are as follows:

Assets.	Book Value.	Actual Value.
1445 Shares, of 1000 Gulden each, of the "Oesterreichische Gasglühlicht Actien Gesellschaft," usually known as the "Austrian Company," Patents, Patent Rights, and Goodwill.	£3,460,012	£1,000,625

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

THE

"ROTARY"

STATION METER.

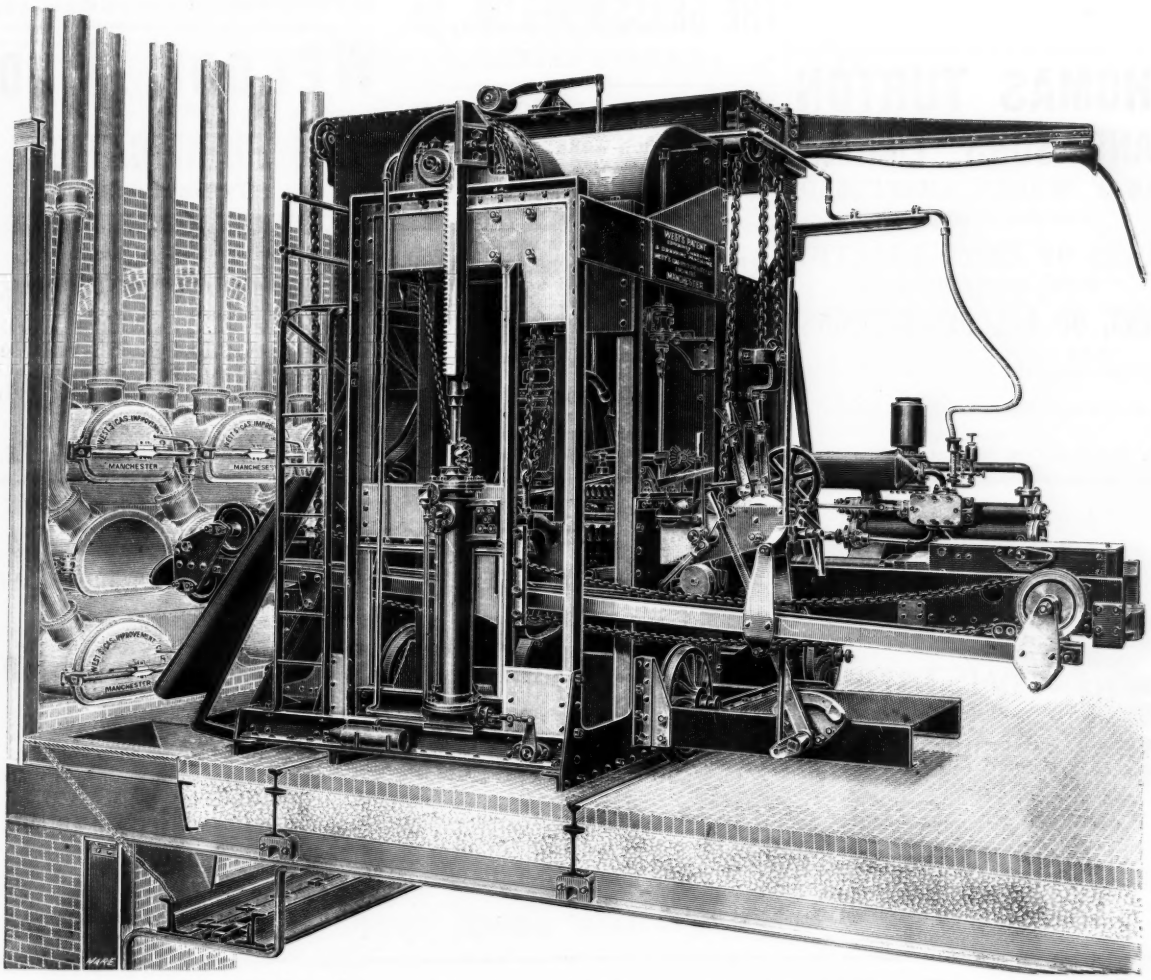
Efficiency Demonstrated.

APPLY—

T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

WEST'S STOKING MACHINERY

COMPRESSED AIR DRIVEN
CHARGING AND DRAWING MACHINES;
COMBINED CHARGING AND DRAWING MACHINES; also
MANUAL CHARGING AND DRAWING MACHINES.



West's compressed Air Driven Charging and Drawing Machine, requiring only One Machine driver and one attendant to charge and draw the Retorts, attend to the Mouthpieces, and fill the Furnaces.

All classes of Coal can be efficiently dealt with by the West's Charging Machines, and the Retorts are charged evenly throughout with the full weight of Coal.

Retort-Houses fitted with West's Regenerator Furnaces, Stoking Machinery, and Coke Conveyors reduce the cost of Carbonizing Coal to a minimum.

WEST'S GAS IMPROVEMENT CO., LTD.,

Albion Iron-Works, MILES PLATTING, MANCHESTER,

AND 104, QUEEN VICTORIA STREET, LONDON, E.C.

Manufacturers for America: RITER-CONLEY MANUFACTURING COMPANY, PITTSBURGH.

THE
PETROLEUM GAS SYNDICATE
Supply and erect Complete Installations of their
PETROGENE PATENT GAS PLANT
On SALE, HIRE, or ROYALTY.

PETROGENE GAS is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.

The Syndicate is prepared to entertain offers of sale of small Gas-Works, whether profit earning or not.

Offices: 28, Victoria St., Westminster.
Works: 10, Rochester Row, S.W.

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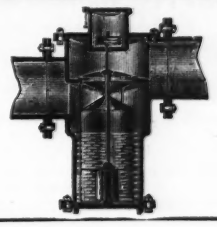

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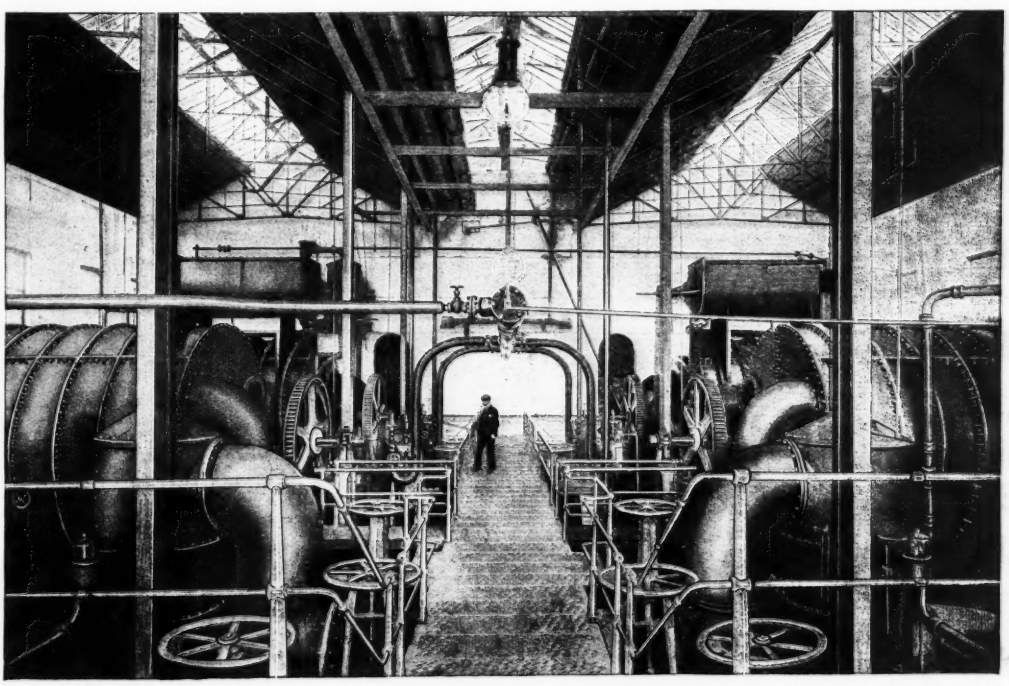

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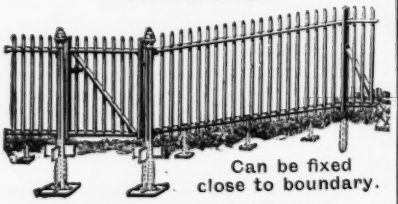

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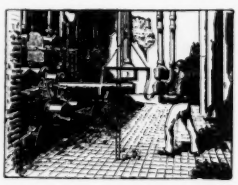

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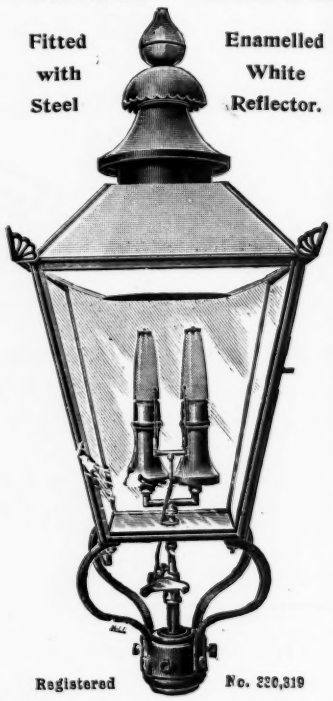

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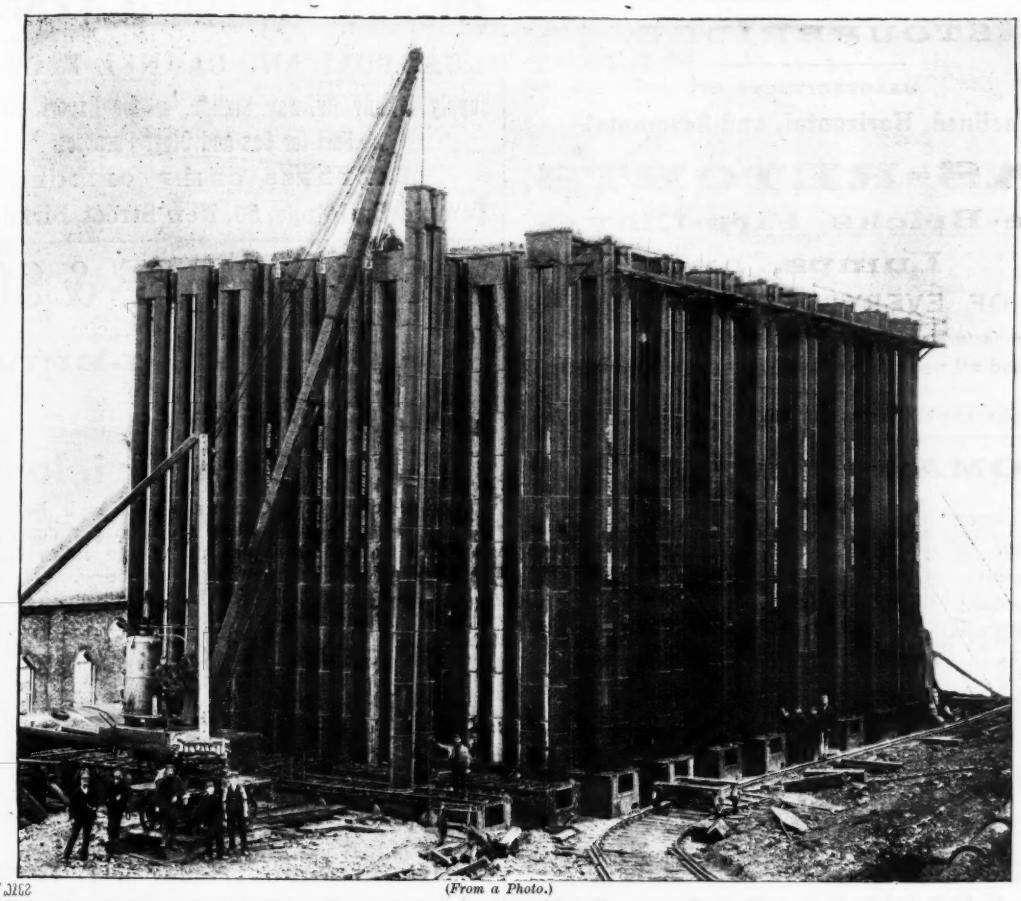

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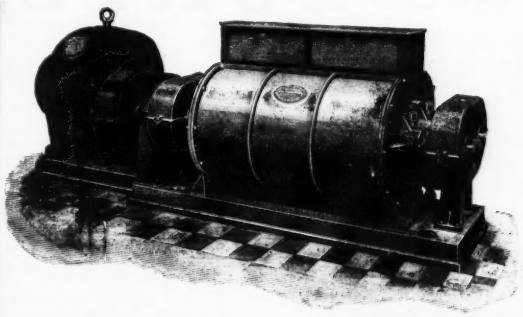

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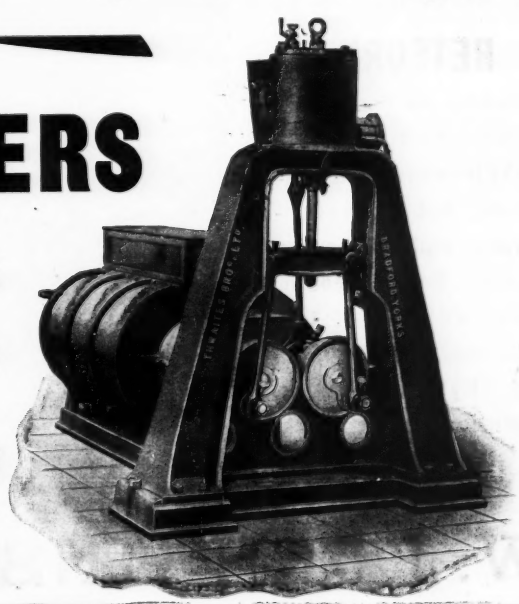

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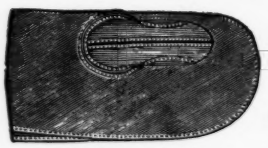

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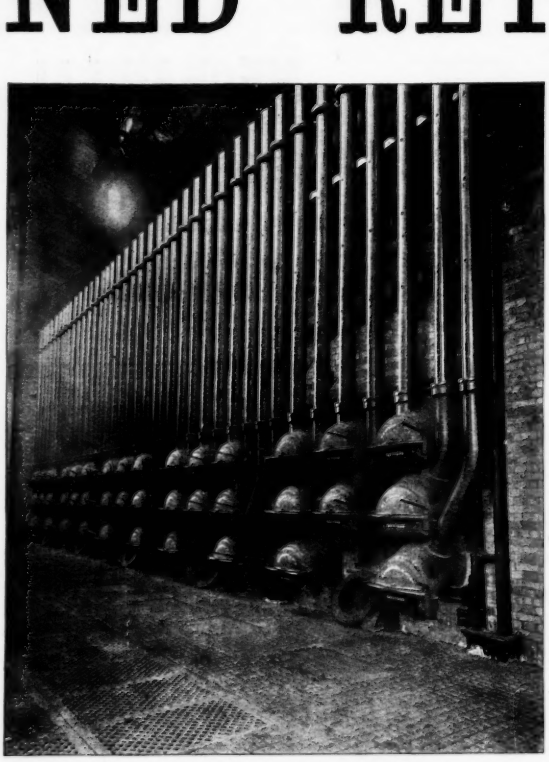

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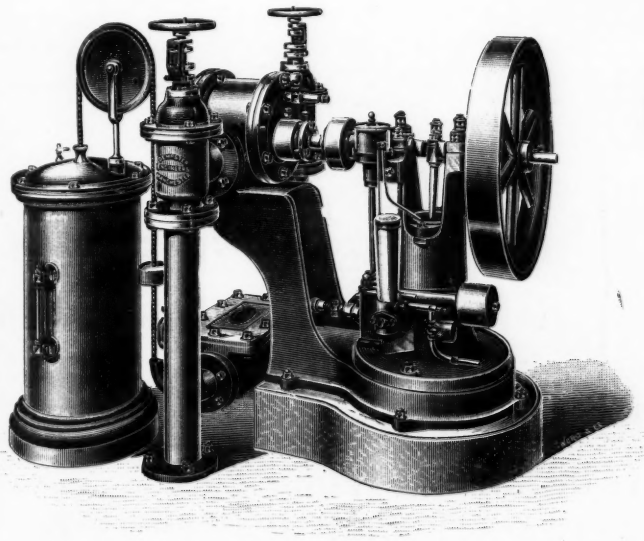

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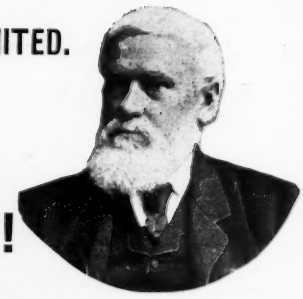

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